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THE TERCENTENARY OF RICHARD HAKLUYT.

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THE name of Richard Hakluyt is kept in perpetual remembrance by the Society which was founded more than sixty years ago to continue his labours; and on the three hundredth anniversary of his death we need not seek to raise any other memorial to him. In the pre-occupation of War we have not been able to make a public celebration of his renown or a full appreciation of his works, as in other circumstances we should have done; but his Tercentenary has not passed unhonoured by the Royal Geographical Society. On the morning of November 23, by permission of the Dean of Westminster, the Society hung a wreath to his memory in the Abbey Church where he lies, though his grave is unmarked and unknown.

In the frontispiece of this number we reproduce from the copy in our library the first page of the dedication which Hakluyt wrote for the earlier edition of the 'Principal Navigations'—one of the rare sources of material for a knowledge of even the bare facts of his life; and with the consent of Prof. Sir Walter Raleigh and of Messrs. James MacLehose & Sons we quote some passages from the essay prefixed to the twelfth and concluding volume of their well-known edition of the 'Voyages.' The reader will do well if he turns to the essay in full, recalling Richard Hakluyt's high vision of Empire, and his ambition for the right education of its builders, for which he laboured unceasingly.

"Richard Hakluyt, the recorder of all these matters, desired no memorial save his book. His relics lie buried under the 'star-ypointing pyramid,' which, by his own incessant labour, he erected to the honour of his country. 'Master of Arts,' he calls himself, 'and sometime student of Christ Church in Oxford.' Except to show that he is not unqualified for his task, and to express his gratitude to the learned foundations where he had his training, he does not speak of himself. He is a scholar, bibliographer, and editor, and so has a threefold title to modesty and self-renunciation. On the title-page of his first book, the 'Divers Voyages' of 1582, his name does not appear; in the second and third volumes of the 'Voyages' he pays his tribute to the church of which he was a minister by

describing himself as 'Richard Hakluyt, Preacher.' He was less of a preacher than was his disciple, Samuel Purchas, and his book is the gainer by it. No biography of him, in any full sense of that word, is possible. Except for a few bare facts and dates, all that we know of him is told us by himself, in his prefaces and his few extant letters. No portrait of him has been recovered. He was buried in Westminster Abbey, but no inscription marks his grave, nor is it known in what part of the church he lies.

"There can be no doubt that this obscurity was of his own choosing; and belonged, as of right, to his character and temper. He had many famous and influential friends and was constantly in traffic with them for the enrichment of his book. They answered his questions, gave him their help, were led on to the topics he had broached, and thought nothing further of the questioner. He acknowledges his obligations to many 'virtuous gentlemen' who, partly from their private affection to himself, but chiefly from their devotion to the furtherance of his work, had lent him their assistance. . . . Yet it is vain to look for traces of him among the works and memorials of the brilliant company that knew him in life. He is the silent man, seated in the dark corner, who is content to listen and remember, and whose questions, interpolated from time to time, divert attention from himself, and direct it to the moving tales that come in answer to them.

"He was born, probably in London, about the year 1553. His family belonged to Eyton, or Yatton, in Herefordshire, and from the time of Edward II. onward, supplied not a few sheriffs and members of Parliament to the service of the country. The family was English, and the name, in its accepted form, owes its alien suggestion to the preservation of archaic spelling. It was pronounced, and sometimes spelt, Hacklewit. . . . He was educated at Westminster School, where he was a Queen's scholar. Thence he passed to Christ Church, Oxford, in 1570, and proceeded in due course to the degree of Bachelor of Arts in 1574 and of Master of Arts in 1577.

"At Oxford, in the time he could save from prescribed studies, he set himself to read and master all the travels and voyages extant in Greek, Latin, Italian, French, English, Spanish, or Portuguese. The first five of these languages he acquired; Spanish remained long unknown to him, if we may judge from his habit of quoting Spanish treatises in Italian, French, or English translations. Having taken his Master's degree, he lectured, 'in the common schools,' on the subject nearest his heart, and was the first, he says, to demonstrate the advance of geography by comparing the new 'lately reformed maps, globes, and spheres,' with the old inaccurate representations. He mentions these lectures but slightly, and we do not know who were his audience.

"Throughout his life Hakluyt continued to urge on the Government and public the importance of sound nautical education. His scheme, although nothing came of it, was a modest one. A lectureship should be established 'in London or about Ratcliffe, in some convenient place'; and he tells how Sir Francis Drake offered twenty pounds a year to this end; but forty pounds a year was found needful to secure a fit man, and, no other donor presenting himself, the scheme fell through. The Spaniards, says Hakluyt, maintain at the Contractation House, or Exchange, in Seville, a learned Reader in the art of Navigation, and no one is given charge of ships for the Indies until he has attended the instructions of the Reader and has satisfied a board of examiners who are joined with the Reader to test theoretical and practical knowledge. This Readership, he points out, has already given to Spain the services of learned writers on the art of navigation, as, for instance, Geronimo de Chavez and Pedro de Medina, whose works are text-books* for the navigators of all nations. What Hakluyt desires, in short, is a Nautical University or Faculty, where men are trained and graduated in all the sciences and crafts that are necessary to furnish forth the complete navigator, and to make him an efficient servant of his country. He returns to the subject in his later dedications, pressing it on the attention of the Lord High Admiral and of Sir Robert Cecil.

"Before the publication of his first book, Hakluyt must have moved from Oxford to London, in what capacity we do not know. Early in 1582 we find him in correspondence with Sir Francis Walsingham, who treats him as a recognized authority on Western discovery. It is a strange thing that he, the recorder of the 'Voyages,' should have taken part in none of them. We hear of two expeditions which he thought of accompanying. One was Drake's West Indies voyage of 1585. The other was the fatal voyage of Sir Humphrey Gilbert in 1583. What detained him, or changed his purpose does not appear. In the year of Gilbert's voyage he was appointed chaplain to Sir Edward Stafford, Queen Elizabeth's ambassador in Paris, and remained for five years in France. Stafford was brother-in-law to Howard of Effingham, so that it seems likely that in this case, as in others, Hakluyt's preferment came to him from his interest in nautical affairs. He was on terms of intimacy with the Gilberts and Raleigh; his 'Discourse of Western Planting,' presented to the Queen in the autumn of 1584, was written at the request of Raleigh, and was inspired by the reports of Captains Amadas and Barlow. It is the longest and most valuable of his extant original writings, though his unvarying modesty prevented its inclusion in his 'Voyages.' In Paris he devoted himself with much energy to the preparation of the book which was now the goal of all his efforts—a collection of the voyages undertaken by Englishmen.

* Pedro de Medina's 'Arte de Navegar' (1545) was translated into English by John Frampton, and published in London in 1581, a year before Hakluyt's 'Divers Voyages.'

The first edition of 'The Principal Navigations,' in one folio volume, appeared in 1589. Then followed ten more years of labour, and the second and final edition, in three folio volumes, was given to the world in 1598 and the two following years.

"The quality of Hakluyt which most impressed his contemporaries was his enormous industry. He often speaks of this himself, and confesses that only an ardent love of his country and care for her good name could have induced him to undergo labours so tedious and exhausting. 'I call the work a burden,' he says, 'in consideration that these voyages lay so dispersed, scattered, and hidden in several hucksters' hands, that now I wonder at myself to see how I was able to endure the delays, curiosity, and backwardness of many from whom I was to receive my originals.' And again: 'What restless nights, what painful days, what heat, what cold I have endured; how many long and chargeable journeys I have travelled; how many famous libraries I have searched into; what variety of ancient and modern writers I have perused; what a number of old records, patents, privileges, letters, etc., I have redeemed from obscurity and perishing; into how manifold acquaintance I have entered; what expenses I have not spared; and yet what fair opportunities of private gain, preferment and ease I have neglected; albeit thyself can hardly imagine, yet I by daily experience do find and feel, and some of my entire friends can sufficiently testify.'

"This strong practical bent and concrete habit of mind served the Preacher well in the designing and ordering of his book. He is not misled by any encyclopædic ambitions or the lust of universality. It is a credit to him, greater than can be readily conceived by our scientific and empiric age, that he sets himself to record individual observations and particular experiences. He had been educated after the fashion of the time in the vague generalities of the scholastic learning; and he would have none of them. It is the story of the travels of this man and that man, he says, which bring us to a certain knowledge of the world; 'not those weary volumes bearing the titles of Universal Cosmography, which some men that I could name have published as their own.' He is careful to ascertain and record the name of the historian of each voyage, as well as the name of the voyager, so that every man may 'answer for himself, justify his reports, and stand accountable for his own doings.'

"To estimate Hakluyt's labours as an editor it would be necessary to collate his 'Voyages' in detail with the printed and manuscript originals, where these are recoverable. A good beginning has been made by the Hakluyt Society; and the complete task, however troublesome, will be no more than a just tribute to those great charges and wearying out of his weak body, from which the Preacher long ago found rest. A comparison of

some of his 'Voyages' with the full originals, printed by the Hakluyt Society, reveals him as a conscientious editor, wholly free from the vanity of self-assertion. He follows his authorities word for word, and takes few liberties with them. He omits nothing that tends to knowledge, though he has a ready pen to excise what tends merely to edification. It was the habit of his age to begin even a nautical diary with a few remarks on the origin of the world, the history of man, and the opinions of Plato. To these excrescences the Preacher gives short shrift. If he was as severe a critic of himself as of other men, his sermons must have been models of terse and pointed exhortation. Master George Best's 'Discourse' of the three voyages of Frobisher begins, in the original, with a dissertation on the sundry employments and delights of men. 'Man is born'—so the overture runs—'not only to serve his own turn (as Tully saith); but his kinsfolk, friends, and the commonwealth especially, look for some furtherance at his hands, and some fruits of his labour; whereupon sundry men finding themselves as it were tied by this bond and duty of human society, have willingly endeavoured sundry ways to show themselves profitable members of the commonweal." All this, and much more, Hakluyt omits, to get on with the practical business of the voyage: 'First, it may be gathered by experience of our Englishmen in Anno 1553,' and so forth. No doubt, by thus stripping off the graces and ornaments of some of his pilgrims, he has diminished the attraction of his book for a student of our older literature; but, on the other hand, he has condensed within the covers of his three folio volumes a far larger amount of valuable practical information than could have been brought within the same compass by a more reverent modern editor. It was utility that he valued; more than the thanks of lovers of elegant prose he would have esteemed the profits of the East India Company, which occupied some part of his later thoughts, and which, according to Sir Thomas Smith, were increased by twenty thousand pounds through a careful study of the 'Books of Voyages.'"

The question of the spelling and pronunciation of Hakluyt's name is of some interest. We have noticed that Professor Sir Walter Raleigh says confidently that it is pronounced and sometimes spelt Hacklewit. He quotes in support of this claim the verses of Drayton in his "Ode to the Virginian Voyage":

> "Thy Voyages attend,
> Industrious Hackluit;
> Whose reading shall inflame
> Men to seek fame,
> And much commend
> To after times thy wit."

The scansion undoubtedly requires that the name shall have three syllables, but the rhyme does not suggest the pronunciation of Hackle-wit

but rather Hack-lew-it. Some light is thrown upon the matter by a passage in Leland, and by others founded on it, to which our attention has been called by Mr. J. H. Reynolds, and which does not seem to have been noticed by the editors of Hakluyt.

'The Itinerary of John Leland,' Vol. 4, Fol. 178:

"From Lemster to Eaton a Mile by West North West. One William Hackluit that was with K. H. 5. at the Battaile of Agin-Court sett up a House at this Village, and purchased Lande to it. He had one S^t. George, a Noble-Man of France, to his Prisoner. Hckluit now living is the third in Descent of the House of Eaton. The cheife and ancientest of the Hackluits have beene Gentlemen in tymes out of Memory, and they tooke their Names of the Forrest of Cluid in Radnor-shire, and they had a Castle and Habitation not farre from Radnor. There were 3. Kts. of these Hackluits about the time of K. E. 3. whereof one was named Edmond. It chanced in K. E. 3. tyme that one of the Hackluits tooke part with Llioline, Prince of Walles, against K. E. 3. Whereupon his Landes were attainted and devolved to the King or to Mortimer Lord of Radnor, and never were restored.

"There was at that tyme one of the Hackluits that fled into the Mountaines of Walles, and lived as a banished Man, but he after was pardoned, and havinge a Knight that tendered him, because he was his Godsonne or Kinesman, and had noe Issue, he made his Heire, and those Landes yet remaine to the Eldest House of the Hackluits.

"Mr. Hckluit tould me that the Body of Kinge Merewald was found in a Wall in the ould Church of Wenlok."

In the 'Leominster Guide, 1908,' compiled according to a MS. note by the Rev. Jonathan Williams, Master of the Leominster Grammar School, on page 331 there is this passage, based upon Leland, but with a precision in the derivation of the name which is apparently not due to him:

"One mile south-east from Leominster is Eaton, formerly the seat of the Ap-Llhwyds, or Hackluyts. 'The chief and ancientest of the Hackluyts,' says Leland, 'have been gentlemen in times out of memory; they took their names of the forest of Clwyd in Radnorshire, and they had a castle and habitation not far from Radnor.' William Ap-Llwyd, or Hackluyt, as appears by the same author, was at the battle of Agincourt, which was gained principally by the astonishing exertions of the Welsh Infantry, and afterwards 'set up a house in this township,' having brought home with him a rich prisoner, named Chevalier St. George.

"This once splendid mansion, which had long remained in a ruinous condition, and whose chapel had been converted into a hop-kiln, has been recently pulled down and rebuilt into a commodious and respectable farmhouse. Another branch of the Ap-Llwyds, or Hackluyts, settled at Eaton or Yatton near Aymstry. Of this family, Walter Ap-Llwyd, or

Hackluyt, was high-sheriff of this county, during the first four years of Edward II.; the same office was also filled by several others of the family, down to the reign of Henry VIII.; two of whom, in the reign of Mary, represented in parliament the borough of Leominster, in the church of which several of them lie buried. Of this family was Richard Hackluyt, the author of the 'Collection of Voyages' which go under his name."

These passages taken together furnish an interesting derivation of the name, which accounts at once for its un-English appearance and its unexpected pronunciation. If "Llwyd" may properly become "Clwyd" and be pronounced "Cluid," then it does not seem on the face of it improbable that "Ap–Clwyd" may become "Hakluyt" by spelling and "Haklu-it" by pronunciation.

To Mr. Reynolds, himself an old member of the foundation, we are indebted also for some passages from the 'Alumni Westmonasterienses,' New Edition 1852, in which it appears that two of Richard Hakluyt's three brothers, Thomas and Oliver, were also Queen's scholars of Westminster, as was his son, Edmund Hakluyt, who was elected from Westminster to Cambridge in 1611, and to whom his father bequeathed the "Manor of Bridgplace" and several tenements in "Tuttle Street," Westminster.

In the passages quoted above it is said that Richard Hakluyt's family belonged to Eyton or Yatton in Herefordshire. There is here some possibility of mistake. Leland (*loc. cit.*) says "From Lemster to Eaton a Mile by West North West" [almost certainly a mistake for E.S.E.]; and in 'An Historical and Topographical Account of Leominster and It's Vicinity,' by John Price (Ludlow, 1795), p. 158, we have: "Eaton, called in Domesday Estune, about a mile to the south-east of Leominster. The Hakluyts became possessed of it, but at what time cannot be ascertained;" while on p. 142, in a note on the Members of Parliament for Leomińster, 1557, Alban Byrche and Richard Hackluyt, we have: "This Hackluyt was Lord of Yatton near Aymstry and Eton near Leominster, and of a very ancient descent; he was a great traveller, and published sundry voyages," etc. [This is of course a confusion between the two cousins of the same name.] But on another page he is called Lord of Yatton and Eaton.

In the passage in the 'Leominster Guide,' already quoted, we see that "Eaton near Leominster" is given as a former seat of the Hakluyts; while "another branch of the Hackluits or Hakluyts settled at Eaton or Yatton near Aymstry, and of this family was Richard Hakluyt, author of the 'Collection of Voyages.'"

The conflicting or at any rate confusing accounts of the seat or seats of the family is not altogether the fault of the chroniclers. Aymestrey is about six miles north-west of Leominster, with Yatton Court and then Yatton slightly east of north and a mile or two away. Eyton is between

Aymestrey and Leominster, rather nearer the latter. Eaton is about a mile on the opposite side of Leominster. Probably we may identify Leland's Eaton with Eaton above, as the residence of the knight of Agincourt. But if this is so, then the editors of Hakluyt are wrong in speaking of Eyton or Yatton: they should say Eaton and Yatton. The clearing up of the confusion may give some pleasure to a disciple of Hakluyt on the occasion of his tercentenary.

A JOURNEY TO THE SUMMIT OF MOUNT RORAIMA.

Mrs. Cecil Clementi.

Map, p. 520.

THOSE who have spent any length of time in a flat tropical country at sea-level know the depression of mind and exhaustion of body to be endured when leave is indefinitely postponed, and will readily understand why, after two years on the flat coast-land of Demerara, 4 feet below sea-level, with never a hill to be seen, and the Atlantic "slopping over" in waves of muddy yellow water, my husband and I decided to spend a brief six weeks' leave in exploring a part of British Guiana which, although for over a hundred years under the British Crown, is blank upon the map. My husband in October 1915 had made the acquaintance of Mr. J. C. Menzies, whose occupation as a diamond and gold prospector had carried him into distant parts of our Colony's interior, and his account of prairie tablelands at high altitudes to be reached in eight days from Georgetown, affording a view of the famous Mount Roraima, determined us to attempt a journey to this mountain under his guidance.

The colonists of British Guiana have never made any serious attempt to investigate the interior of their heritage. Their revenue has always been spent upon sea defence and coastal development, and a conviction exists that the hinterland is not only a death-trap but also a wilderness of useless jungle and sandy deserts. I was assured that I was risking my health; but the fact that I returned with health and vigour renewed may perhaps dispel the legends accumulated about the horrors of the bush, and induce people to investigate for themselves the charms and opportunities of this neglected land.

We left Georgetown on 2 December 1915, and travelled 60 miles by steamer up the Demerara River to Wismar, whence a light railway 18¾ miles in length carried us over the low divide between the Demerara and Essequibo rivers to Rockstone on the banks of the Essequibo, where there is a small hotel. Thence we travelled by launch some 55 miles up the Essequibo to the mouth of its tributary the Potaro, and thence another 10 miles up the Potaro to Tumatumari, where a large and very picturesque

cataract bars the way. The Essequibo in its lower course is too wide to be interesting, but the Potaro is very pretty, winding its sluggish way between banks covered with thick forests, whose dense tropical foliage is reflected with wonderful clearness and brilliance in the river.

At Tumatumari there is a little rising ground on which stands a village with a post office and small bungalow-hotel. The portage from the lower to the upper landing is about half a mile by a good cart road. From the upper landing at Tumatumari a small launch carried us 10 miles further up the river to Potaro landing, where the launch service ends. A road runs from this point to the Minnehaha gold-mines, some 18 miles away; and we followed this until at the second milestone we struck off along 4 miles of forest trail to Kangaruma. Here we rejoined the Potaro, which bends back on itself. The Pakatuk Falls, a series of big cataracts, are avoided in this way.

At Kangaruma we embarked in a boat, the property of Sprostons, Ltd., our party consisting, besides our two selves, of Mr. Menzies, a black cook, and fourteen Indians, of whom nine were from the Demerara River and five Makusis from the high savannahs. Two of these five, Johnny and Thomas by name, were headmen of Puwa village and proved very useful to us. The other three were picked up at Rockstone, where they were waiting for a job. All five were good fellows and did yeoman service. But the natives of the Demerara River were an idle and useless set, and we endured much delay and annoyance at their hands, until we were able to exchange them for the willing and friendly Makusis and Arekunas of the high levels.

The splash of the paddles was very welcome after the din of the launch travel and we spent a very pleasant afternoon paddling up the reaches of the Potaro to Amatuk, where a cataract once more interrupts the river's repose. Splendid forests clothe both banks of the river, the monotonous tropical green being broken here and there by some brightly blossoming tree or creeper. Behind us, on the left bank, stood a range of flat-topped, cliff-faced hills. At the edge of the cataract at Amatuk a small rest-house stands, owned by Sprostons, Ltd. To our delight we each of us needed a warm blanket that night. When you have scarcely used the lightest blanket for months, it is a real luxury to enjoy a good heavy one again.

At Amatuk the Potaro descends in two cataracts round a rocky tree-crowned island, and then swirls back into a little bay in which is the lower landing-place. The bungalow stands on a low hill immediately above the bay and at the side of the smaller cataract. This hill has been cleared of the dense forest and delicious English bracken grows freely on its slopes. Above Amatuk the Potaro flows in a gorge between flat-topped mountains whose summits and bases are clothed in forest, whilst their grim sides are vertical cliff.

At Waratuk a portage has again to be made, though the cataract is much

smaller than at Amatuk and can sometimes be run, whilst no one could dream of attempting Amatuk, in the centre of which is a big vertical drop.

From Waratuk to Turkeit was two hours' pull. The shining lazy river, lying half asleep between its sentinel hills, seems already to have forgotten the wild leap over the Kaietuk precipice which bars the gorge. Above the river is not navigable until you are above Kaietuk. Sprostons' rest-house at Tukeit has been placed in a clearing, slightly above the river-level, about 300 yards from the bank, where there is no air and no view. This is the greater pity as there is a low hill close by from the top of which, if it were cleared of forest, one would have a view of the Kaietuk fall itself and of the lovely rocky reaches below it. At present, unless a very difficult and laborious scramble is taken up the gorge above Tukeit, no view of the waterfall from below is anywhere obtainable. The camp at Tukeit is full of big biting cow-flies, and one would be very well advised to make a very early start from Amatuk and insist on reaching Kaietuk the same day, thus avoiding a stop at Tukeit altogether. Unless the river were very high this could be managed.

From Tukeit to the Kaietuk plateau is a climb of about 1500 feet, of which only a small portion is really steep, after which the path runs for some distance along the plateau, always in forest. We spent two hours in walking from Tukeit to the rest-house on the plateau, and nowhere could we obtain even a glimpse of the great fall until when we reached the rocky savannah on which Sprostons' bungalow stands and had made our way to the edge of the gorge.

The lazy, dreamy Potaro leaps down fully 800 feet into a great black cauldron below, and then flows between precipices of equal height, their bases clothed in forest. The river was low, so that comparatively little water was going over, and it looked as though the whole mass turned to spray before reaching the black depths beneath; but sometimes a rush of wind blew the foam-curtain aside for a second, and one caught a glimpse of the amber column descending. The contrast between the black and red stained cliffs and the gleaming, falling water is marvellously beautiful.

From the cliff-edge near the bungalow one can see the entire fall and the tumbling reaches of the river below, which alternate with large still pools. One can also look upstream over the vast densely forested plateau stretching away to the distant blue hills, forest clad save on their vertical cliff-sides. From a jutting rock about a mile from the edge of Kaietuk, to which Sir Walter Egerton had a trail cut through the forest, it is possible to photograph the fall in its entire length, which cannot be done from any point nearer. There is also a trail to the brink, where one obtains a wonderful view down the gorge to Amatuk and the dim plains beyond, a distant sea of forest; but from this place it is of course impossible to see much of the chasm into which the river falls, unless you lie prone on the overhanging rock and look straight down.

Round about the head of the fall on the left bank is a curious open

KAIETUK FALL, POTARO RIVER, BRITISH GUIANA
From a negative taken by Sir Everard im Thurn in 1878 at time of drought

BARAMAKU-TOI

FORDING THE KOTINGA RIVER

MOUNTS WEITIPU AND MUKÖRIPÖ FROM THE LEFT BANK OF THE KOTINGA RIVER

plain of hard smooth rock. It is almost entirely flat, and is strewn with small round white pebbles. Only a few bushes and big orchidaceous plants grown on it. It must be a good many acres in extent, and the dense forest with huge boulders beneath its trees girds it all round. It was the only patch of ground clear of forest on our way between the coast-lands and the high savannahs.

The spelling "Kaieteur" usually adopted is a mere mistake. The word "kaietuk" (Dr. Bovallius writes it Kaijituik) means "Old man's rock"; and the falls are so named by the Indians because of a folk-tale to the effect that an aged Indian, becoming a nuisance to his relatives, was put in a woodskin and allowed to drift to his death over this chasm. The word "tuk" or "tuik" means "rock," and is also to be found in "Pakatuk," "Amatuk," "Waratuk," and "Tukeit," all of which are well-known cataracts on the Potaro river.

Two boats are kept about a mile and a half above Kaietuk in a little cove on the left bank of the river. One is a "parson's boat"; the other, belonging to Mr. Menzies, is very handy and light, 30 feet in length and built of silver-balli wood, which is extremely buoyant. Mr. Menzies brought it up from Georgetown in sections and screwed it together with the help of two men in the little cove aforementioned, where it is safely housed even in flood-time.

The Potaro above Kaietuk is as calm and peaceful as below Tukeit, and the primeval forest is unbroken on both banks, save occasionally where patches of secondary jungle and "congo-pump" suggest that in bygone days there were Indian settlements on the banks, now abandoned, probably for "kenaima" reasons. Whenever a chief dies in an Indian village the people are apt to attribute any run of bad luck to his "kenaima," or spirit, and they migrate from the place. Indeed, a village is nearly always deserted for a short time after the death of any important person. There are also whole districts into which Indians will not go for fear of "kenaima."

At the junction of the Potaro and Chenapowu several trails from the high savannahs converge, and here it was that an old Swedish gentleman, Dr. Bovallius, some years ago made a settlement, which he called Holmia. He cleared about one hundred acres of land and built himself a house admirably situated on a hill overlooking the two rivers, furnishing it with every comfort. He began a trade in balata with the Indians of the neighbourhood. Mr. Menzies did the transport work for him, and by his direction explored the forest-trails to find a short line to the high savannahs. It was thus that he found "Menzies' line," which balata-laden Indians could travel in two days, and which is certainly an excellent path from the Potaro to the high levels. Dr. Bovallius' foreman estimated it to be 32 miles long when it was cleared and made straight. Now it is covered with fallen trees and débris and must be rather longer, as détours are made to avoid all the bigger obstacles. It is unfortunate that Dr.

Bovallius did not come here as a young man; for he was over seventy years of age when he began his enterprise, and though he lived to be seventy-eight yet time was lacking for him to establish it on firm foundations. When he died the Indians carried off everything that could be possibly removed, and his entire clearing is now covered by secondary growth and the horrible "congo-pump" tree, which, bearing a ghastly resemblance to rubber, grows only where a clearing in the primeval forest has once been, and appears to mock abandoned human endeavour. There are still remains of Dr. Bovallius' roads and bridges to be seen, and a small corrugated-iron powder-house exists in good repair to this day.

At Chenapowu we left the river and began our long march with Makusis of the high savannahs as our baggage carriers. Leaving on our right the Tumong trail, by which all previous travellers have gone to Roraima, we marched to the Akrabanna. The path is comparatively good going; there are two low hills to climb and several creeks to ford, the largest being the Chenapowu itself. The silver sand bottom of these creeks contrasts prettily with the amber bush water. At the summit of a low bracken-covered sandhill is the junction of the Arnik trail with "Menzies' line" to the high savannahs. The road lay for a long time on a level ridge forming presumably the divide between the Chenapowu on our right and the Akrabanna on our left.

After two days we reach a low saddle with a little swamp out of which two tiny streams trickle in opposite directions. We assumed this to be a water-parting between the Essequibo and the Amazon, for on our right a valley went down in the one direction of the Siranibaru, which flows into the Potaro, and thus into the Essequibo, and on our left was the valley of the Yawong, which flows into the Kowa river and thus into the Ireng and Amazon. A little further on the Arnik trail came in on our left, having come up *viâ* Mount Enwarak (the Nose Mountain). Here "Menzies' line" ends, and from now onwards we were on the main trail between Arnik and Baramakutoy.

At last, after seven days' march, we emerged into the sunshine of the lovely Baramakutoi or savannah of Baramaku to find ourselves standing in the scented, flower-starred grass, able to look over long views of distant tiers of hills into fading blue distance, whilst sunshine warmed us, and the most delicious cool and fragrant breezes blew in our faces. The savannah is a small one, about 3 square miles.

From the top of the ridge which bounds Baramakutoi on the east, the ground drops down very steeply into the densely forested Yawong valley, beyond which one can see shoulder upon shoulder of forest-clad hills rolling into distance. From this ridge the savannah descends towards the north-east in gentle undulations, with softly contoured knolls whose copses and bracken slopes remind one of Dartmoor. All round is dark forest, and to the north, beyond the depression of the Kowa valley, Kowatipu rises a thousand feet or more above the trees, a rectangular

plateau edged by cliffs. He is a magnet for all the rain of the neighbourhood and is generally wrapped in forbidding mist. It is strange to think that this ideal spot for a European health settlement, only two days' journey from the Potaro if transport is properly organized, and less if a bridle track were made, is absolutely unknown and uninhabited.

About two hours' march through the forest is the savannah of Kwaibaru, not nearly so charming as that of Baramaku. It is a succession of very steep little valleys; three houses are perched on the hill, at the side of which the path emerges from the forest, and there are two more on a hill a little further on. The houses of the savannah Indians are as a rule circular, about 30 feet in diameter, and they accommodate a large number of people and dogs. The walls are of mud, about 4 feet high, but the thatch slopes up sharply to a high pointed top, so that inside there is a sort of upper storey, where provisions can be stored out of the way of the starving curs which abound in every village. The houses are lighted only by the doorway and are therefore very gloomy within, the reason for this being that the pest of the savannahs, the biting "kabouru" fly, never enters a dark place. The doorways generally face north-east so as to get as much breeze as possible, the wind blowing almost steadily from that quarter over the savannah as it does on the coast.

From a hill ridge, before descending the very steep forest slope to the Kowa river, we got our first view of the big savannah, rising a shining tableland high up behind smaller forested hills on the other side of the river. It is a glorious plateau, which forms part of the area over which Mr. Menzies has obtained a grazing permission, at an average elevation of 2400 feet, and walking was perfectly delightful in that exhilarating air. We had enchanting views of blue distance in all directions. Far away on our left the tableland was bounded by the rift of the Kowa river, beyond which rolling forest-clad hills faded into the horizon, whilst nearer to the right the headwaters of the Chiung river wound away among green savannah mountains, in the knees of which lay little rounded terraces and small gulleys, studded with Eta palm. These hills form another tableland, about 500 feet higher than the one over which we were making our way, and would probably be a good country for sheep. None of these smiling, healthy highlands are marked on the colony's maps, and their very existence has been steadfastly denied.

Mount Mataruka lay south-west of us, almost in a straight line with our path, but we made a détour to take us to Puwa village, and left the tableland to drop down 700 feet into a river valley, where four streams from off Mr. Menzies' plateau unite to flow as the Kowyann to meet the Chiung river near Chiung village.

We took our way down the Kowyann valley, steep grassy hills rising on either side of us. We travelled alternately through little savannahs, whose long waving grasses and crooked trees had a curious resemblance to an English orchard, and through patches of woodland, where a broad

bridle-track had been cut for us by our good Makusi friends. The shade in these little forest belts was very grateful as the sun was extremely hot. When we reached Chiung village we found a large assemblage of Makusis, all very pleased to see us. They explained that they had cut the broad trail all the way to Puwa for us, and they provided an abundance of cassava and cassiri for our bearers. The village consisted of two houses, with a third unfinished one which was being erected for us. Until darkness fell we were much troubled by the biting "kabouru," which are slightly larger than the ordinary sandflies. Their bite is much more irritating and raises a red lump with a black spot in the centre. Though this lump soon dies down the black spot remains for some days. Kabouru flies are always found near water; and we had to pay for our close proximity to the Chiung river, which flowed with a delicious noise close to our house. The path followed from Chiung to Puwa was nothing more than a big détour round a hill. We should have preferred a short cut over the summit, but the Indians having prepared a road for us with much care along the valleys we felt it would be ungrateful not to take their line. This ran through a thick belt of forest fringing the banks of the Chiung, and they had most carefully straightened and cleared the forest-trail to a width of 6 to 10 feet, removing most of the stumps, while in places they had actually swept it clear of fallen leaves. The trees, though small, were of hardwood varieties, such as purpleheart and letterwood, and the road-makers were justly proud of their work.

Beyond Puwa the road runs first through an almost level open savannah valley, where rice is grown, and then slopes gradually up to the top of a hill immediately above the Ireng, which commands one of the best views of the whole country. To the south lies the fertile-looking golden Mataruka plain crossed by a stream; to the east-south-east a tangle of big hills beyond the Ireng; to the east-north-east the Puwa hill and a little piece of Menzies' tableland; from north through west to south, beyond the winding Ireng, the most glorious stretch of open rolling grass hills and valleys that one could wish to see; and beyond all that, in the far, far distance, Roraima's great block some 60 miles away.

We crossed the river to the Brazilian side, landing at the point where the Waikana creek from the Mataruka plain flows into it, and set out over the plain to Mataruka village at the foot of Mount Mataruka, where we found a large population drawn up in two long lines with chief Albert at their head, waiting to shake hands.

Albert has a very nice church, with a pointed apse, a picture of the Madonna and Child, and a floor raised above the ground with logs on it to serve as pews for the congregation. He has lengthy prayers and hymn-singing every night and morning. We could frequently catch the words "Ave Maria" and "Spiritus Sanctus," and whenever the congregation fastened on any phrase or tune they knew they all shouted together lustily

MOUNT KOWATIPU FROM MR. MENZIES' TABLELAND

ON THE SUMMIT OF MOUNT RORAIMA

KUKENAAM and RORAIMA from KAMAIWAWONG

Albert intones rather well, having been taught by a Roman Catholic priest who sometimes comes up from the south.

From Mataruka our path sloped upwards between Mount Mataruka and Mount Kako. When after over an hour's climbing we reached the final ridge, the view was glorious and the air keen and invigorating to the last degree. From this point the most striking feature of the landscape is a peak far away on the left, which the Indians call Chakbang. It looks in shape somewhat like a clenched fist, with one finger pointing to the sky. This mountain is indeed a surveyor's friend, for it is visible from nearly every elevated point in the country.

We descended by a steep valley into another golden plain—that of Rera, almost as large as Mataruka, well watered and with cattle in it. From this plateau it was five days' march to the foot of the mountain, by Paröwopo and Enamung to Kamaiwawong.

On January 15 we made the ascent of Roraima, most fortunate in having a cool grey morning, whilst the mountains were still quite clear. There was heavy dew on the grass, and it was delightful walking up the savannah slopes. The path winds continually uphill over long grass with big boulders lying on all sides, much as they do on Dartmoor tors, whilst the depressions are boggy and full of marsh plants. From Kamaiwawong to the brink of the forest was a steady three hours' walk with no halt, and we reached the forest edge at 6510 feet above sea-level. Our guide introduced the place to us as "English pappa banaboo"; and we thought he meant to indicate it as the site of Sir Everard im Thurn's camp. He made the first ascent on 18 December 1884 after spending a month in camp at the foot of the forest belt while his Indians cut a trail to the toe of the ledge by which alone the cliff-face is surmounted.

The climb through the forest belt is the only disagreeable part of the whole ascent. The ground here is a pell-mell of huge boulders, over which grows a mass of small trees and magnificent tree-ferns, rooting on the débris of earlier fallen jungle, which is covered with a carpet of shiny green moss and has a horrid corpse-like smell. The whole place is dank and cold to the last degree; and the moss makes it impossible to know whether one is planting one's foot on a piece that will hold, or on a rotten tree-branch, or on a mere covering of twigs and leaves over a chasm between boulders. It is a thoroughly nasty piece of going, and one must use hands and feet almost equally. It lasted two hours, and I must confess that part of the time I was very unhappy. After reaching the ledge the path is still in jungle for a little way, but with the precipice rising sheer on the right hand. Gradually the ledge widens and the forest drops away, so that one gets a glorious view of the country, spread out below like a great green sea. Lovely flowers abounded at our feet, and the air was like a tonic after the damp oppression in the forest. A troublesome feature of the ledge is that it has three V-shaped descents in it; these are very steep and we had to slide down, clinging on to every root, bush,

or stone we could catch hold of. Getting up again was of course more difficult, and in the second place we used a rope. It could be managed without one save for the baggage, which must be pulled up. At the third dip the ledge passes under a waterfall, when after a heavy shower of rain doubtless a great deal of water comes down; then it would probably be very dangerous to try to pass underneath; but on this occasion it was only falling in drops like a heavy and ice-cold rain shower. The rock is very slippery, but it has weathered into convenient little steps and presents no real difficulty. From this point the ascent is direct and steep, and in three hours from the foot of the cliff we reached the top of the escarpment, 8625 feet above sea-level. Roraima was kindly disposed towards us, for we had the rare luck of an absolutely still cloudless evening in which to look about us at the extraordinary scene.

The summit is covered with enormous black boulders, weathered into the weirdest and most fantastic shapes. We were in the middle of an amphitheatre, encircled by what one might almost call waves of stone. It would be unsafe to explore this rugged plateau without white paint to mark one's way, for one would be very soon lost in the labyrinth of extraordinary rocks. There is no vegetation on Roraima save a few damp-sodden bushes (*Bonnetia Roraimæ*), and fire sufficient for cooking can be raised only by an Indian squatting beside it and blowing all the time. Directly the sun had disappeared it felt desperately cold, and we longed in vain for bonfires to warm ourselves. At 6.15 p.m. the thermometer was 51° F.; not very low, of course, but when you are used to such high temperatures it feels like freezing. Any party wishing to explore Roraima's summit would have to organize matters so as to let their Indians spend the night in the forest below and occupy the day in bringing up firewood for them.

The morning sun, gaining power, dispelled all mist, and we revelled in the great sweep of air and view in front of us. Our old friend Chakbang was the only hill that looked more than an earth-wrinkle, save for some cliff-faced mountains far away in Venezuela, which must be as high as, if not higher than, Roraima. We had a good view of the summit of Kukenaam, the same expanse of grotesquely weathered rocks arranged in the same curious amphitheatres. Then we set off in an endeavour to reach the edge of the gorge between our mountain and Kukenaam; but a great chasm lay across the path.

Shortly after 11 a.m. we set out on our return journey. The steepness of the descent made it almost as slow a business as getting up had been. Mercifully the forest trail was much improved by the fact that all the carriers had climbed after us, so that the moss had to a great extent been trodden away, and we could see where to put our feet. How the Indians managed to negotiate that climb with loads on their backs without breaking their legs was beyond our comprehension. They were a good deal cut and scratched, it is true, but their prehensile toes saved them from

all more serious damage. Indians catch hold of things by their toes in truly monkey fashion; and if a man drops a thing on the march he picks it up by his toes and puts it into his hands to avoid stooping; our feet seemed stupid, clumsy things by comparison. We spent 1¾ hours descending to the edge of the ledge, during which time we enjoyed most exquisite views; one hour and fifty minutes in the forest, after which a leisurely descent of 2½ hours over the savannah slopes brought us to Kamaiwawong.

When on our return journey we emerged on a bluff above the Kotinga near Joseph's Ford we were delighted to see a novel aspect of Roraima. The morning was gloriously clear, and behind Weitipu on the left Roraima's south-eastern face projected clear and red, and beyond that again Kukenaam's southern face, whilst on the right of Weitipu we saw plainly not only the other end of Roraima's south-eastern wall, but also a small and fore shortened portion of the eastern cliff. This view enabled us in a small degree to grasp the enormous area of the mountain, which it is impossible to do when one is opposite one great wall only. Roraima is an immense irregular quadrilateral, of which the south-eastern side, 10 miles in length, is the longest.

On the march back to Mataruka we saw a big waterfull shining white in the distance. Our guides said it was a fall on the Wairann, and at close quarters it must be a fine sight, for even at a distance of about 7 miles it was a striking feature in the landscape.

On the way down my husband made inquiries as to a way of reaching Enamung by a direct line, avoiding Puwa and Mataruka. He learned that there is a trail crossing the headwaters of the Chuing, going on thence to a ferry a great deal higher on the Ireng than the Mataruka one, and so to Enamung *viâ* the Wairann river. This is a two days' journey, and my husband's map indicates how great a détour would thereby be avoided.

The following extracts are from a lecture delivered by Mr. Cecil Clementi in Georgetown on 29 *March* 1916, *as reported in the "Daily Argosy" of March* 30. *The map and section are reproduced from drawings furnished by Mr. Clementi, based on the surveys executed by him.*

No British community in the East is contented unless it has its hill station as a city of refuge when the tropical heat of the plains becomes unendurable. The words "a plateau between 2000 and 3000 feet above sea-level" were therefore a lure to me, particularly as Mr. H. P. C. Melville, the Commissioner of the Rupununi District, reported June 29 last as follows:—"The locality chosen by Mr. Menzies is an exceedingly pretty and healthy one; the climate may almost be called temperate, and there is abundance of running water all the year, the want of which is such a drawback to the plains." I had visions of finding a hill station within reasonable distance of Georgetown, which might be to British Guiana

what Kandy and Nuwara Eliya are to Colombo, what Simla is to Calcutta, what the Peak is to Hong Kong, or Kuling to Hankow, or Chuzenji to Tokyo.

The Colony might well spend a little money on making the most glorious scenery [of the Kaietuk Fall] readily accessible. If the railway to the interior, which many of us yearn for, is one day built along the line shown in the 1913 map of the colony, it will be possible to reach the mouth of the Potaro River from Georgetown in a few hours; and although I speak as a layman and not as an engineer, I am quite confident that it would be possible to construct a motor-road from the point where the Potaro meets the Essequibo to the summit of the Kaietuk Gorge. [Many is the cart-road I have travelled upon through more difficult country!] Now, a motor-road branching off from the projected railway would bring Kaietuk within two or three days' journey of Georgetown. If, however, this project is considered too expensive, there should at least be no difficulty in finding money enough to make a bridle-track from the vicinity of Potaro Landing to the plateau above the falls. This modest instalment of hinterland development need not await the era of railway construction, and cannot, I venture to think, be taken in hand too soon. It would be no mere sightseers' path, for the Potaro, from Kaietuk to the junction with the Chenapowu Creek—a distance of about 30 miles—presents no obstacle to navigation, winding lazily between flat forest-clad banks, and is the main avenue of approach to the savannah highlands. These reaches of the river are eminently suitable for launch traffic; and one day I hope that many a launch may ply busily over them.

The whole march through the forest between the Potaro and Baramaku-toi (*toi* in the Makusi language means "savannah") can be done, and was done by us on our return journey, in 14 hours and 26 minutes. Our average rate of progress I estimate to have been 2½ miles an hour; and the length of the trail in all its windings would therefore be some 36 miles. On the outward journey this march through the forest occupied 16½ hours, and was spread over four tedious days because of the inefficiency of our Demerara River droghers. The gradients of this route are shown in the attached diagram (the altitudes have been estimated by observation of the boiling-point thermometer and the aneroid barometer); and the credit of discovering and cutting it belongs to Mr. Menzies, who accomplished the task some years ago with the assistance of one of our droghers, Thomas, the Makusi from Puwa village, already mentioned. The original object of the trail was to facilitate the droghing of balata through the forest of Holmia.

In days to come I hope that one of the main roads of the colony may lead up to Mr. Menzies' plateau; and, when the time is at hand for

building such a road, I expect that its trace will be carried from the watershed of the Siranibaru into the Kowa Valley by easy gradients, and thence round hill-contours, without ascending the Baramaku or Quaibaru savannahs, up to the high-level tableland at Karto. But the existing trail could with small expense be made into a bridle-track suitable for pack-animals and for cattle; and if this were done you will perceive that the savannah highlands, which are to-day within 19 hours' march of the Potaro at Chenapowu, will be made economically and speedily accessible. A launch would place Chenapowu within two hours of Kaietuk; and by a bridle-track it should be possible to reach Potaro Landing from Kaietuk in two easy stages. It would then be a matter of no difficulty and small expense to travel up or down between the high-level savannahs and Potaro Landing in five days or even less. You will also note that we took 10½ hours to paddle from Kaietuk to Chenapowu and 19 hours to march through forest and savannah to the boundary of Mr. Menzies' ranch, or 29½ hours in all. This means four stages of rather less than 7½ hours each. Moreover, you can, as it is, reach Kaietuk from Georgetown in four days, the stages being Rockstone, Tumatumari, Amatuk, and Kaietuk. Therefore Mr. Menzies' statement that he can reach his ranch from Georgetown in eight days is entirely borne out by the facts of our journey.

Mr. Menzies must be regarded as the pioneer of development in this almost unknown part of our colony; and we all owe him a debt of gratitude on that account. He has had, I am sorry to say, an uphill and discouraging battle to fight. In 1910 he applied for a cattle-grazing permission over 50 square miles of Crown land, situated on the left bank of the Ireng to the eastward of the Puwa Creek. He was met by the astonishing statement that 15 square miles was all the available country for grazing at this point, and he was only granted a permit for that area. However, he persisted in believing the evidence of his own eyes and feet rather than conjectures, which, in the absence of any official survey, had been enfaced upon the map of the Colony; and in the following year he was successful in obtaining a permit for 50 square miles. But the plan attached to that permit represented the tract as extending from the mouth of the Puwa Creek "11·3 miles north and about 3 miles east to the Chiung River," and in no way corresponded to the actual area of the grazing-ground in question. This permit was renewed in last September, so that it will not expire until 31 March 1921; but the plan attached to it is still incorrect, and it was freely said by those who should have known better that "not the hair of a cow" was to be found in this locality. It is therefore of interest to describe Mr. Menzies' ranch in some detail; but before doing so I venture to draw special attention to the fact that, after more than a century of British occupation, much of this colony remains *terra incognita*. This is a reproach to us, and it has not been the record of the British race in other parts of the globe. In

saying this I am in no way reflecting upon the work of the Land and Mines Department. On the contrary, such knowledge as we have gained of the interior of the colony is largely due to the unremitting efforts of the officers of that department. What I mean is that surveys cost money, and that no funds have been provided for the purpose, although under the resolution of Combined Court No. 14 of 27 February 1912 there is ready to hand authority to raise a sum of money "by loan under the provisions of the Public Loan Ordnance, 1869, sufficient to defray the cost of making a full and comprehensive survey of the whole or such portions of the Colony as may be deemed expedient." The resolution did not specify the sum that would be necessary.

Mr. Menzies' tableland is a flat grassy plateau some 2400 feet above sea-level. It is bounded on the east by the Kowa River, on the north-west and south-west by the Chiung River, both flowing in rifts far below the plateau level, and on the south-east and north by hills which divide the Kowa from the Chiung Valley. Its extreme length from north to south is 7 miles, and its extreme width from east to west is some 8 miles. Its area is roughly 50 square miles; and the distance across the plateau by our trail, which ran in a tolerably straight line, I estimate at 5 miles. The whole tableland forms an excellent grazing-ground; and although there was at the time of our visit no water on the central part of the plateau, there were many streams at its edges falling into the Kowa and the Chiung, while across it ran a few dry channels, which are no doubt full of water in the rainy season. An Indian village, named Karto, stands at the north-west corner of the plateau, not far from Mr. Menzies' banaboo. Its provision fields are partly in the tree-clad hills fringing the plateau on the north and partly down in the fertile Kowa Valley, near the point of our crossing, where an extensive area is covered with fruit trees—banana and papaw growing wild. We saw no cattle on the tableland, but the Karto villagers told us that there was a herd on some very attractive-looking pasture-grounds near the head of the Chiung River; for it must be understood that the highlands suitable for grazing are by no means confined to the tableland which we crossed, and from which we could see the savannahs round the upper reaches of the Chiung only a little below our level, while across the valley of the Chiung, lower in its course, we looked up to a yet higher and apparently not less extensive savannah plateau, which Mr. Menzies, to whom it is well known, considers suitable for sheep farming. I may perhaps here suggest that much of the country on the elevated savannahs would be well adapted for growing tea. These attractive and spacious highlands deserve to be developed, and would support a considerable population. They would, as it is, make an admirable hill station. The scenery is beautiful. The climate at the season of our visit was delightful. The locality could be made easily and cheaply accessible from town, and

would, I venture to think, prove much superior as a health resort to the West India Islands. If however cattle and sheep farms are to be established here, it is very desirable that steps should be taken without delay to put a stop to the pernicious habit, prevalent among both the Makusis and the Arekunas, of setting the prairies on fire. They do this partly in order to make clearer their trails in the savannahs, where high grass is apt both to conceal the path and to impede progress; partly as a measure of precaution against snake-bite—a somewhat remote danger, for we only saw two snakes during the whole of our march over the savannahs; partly as a signal of approach; and partly, I believe, merely for the joy of watching a good blaze. The effect of these frequent burnings is to impoverish the land and to faciliate the action of water in eroding the hill-sides; but, without doubt, as cattle farming extends in these localities, the aborigines will realize that it is contrary to their own interests thus to devastate their splendid pasture-lands.

In passing I may mention that from Mr. Menzies' tableland I did not see Mount Roraima, although I did get a good view of Mount Chakbang. I do not, however, doubt that from one or other of the savannah hills which surround this plateau it would be possible to see Roraima, if by fortunate coincidence one reached the proper point of observation at a time when that mountain was free from cloud; for on the way back we saw Roraima from many hill-tops, and even from valleys, which on the way out had vouchsafed us no such view.

It is evident that it would be possible to reach Enamung from Mr. Menzies' tableland by a route far more direct than ours had been. Indeed, Joseph afterwards told us of a trail leading from Karto village to Enamung in two stages. That would undoubtedly be the best line for any future traveller bound for Roraima, as the long détour through Chiung, Puwa, Mataruka, and Rera is thus avoided.

The plateau does not continue to the foot of Mount Roraima, for there intervenes on the north a forest valley of much lower level between Mount Weitipu and Mount Roraima, while Joseph's trail at the end of the tableland dropped sharply by steep-sided terraces, some 1000 feet, in the course of an hour, to the valley of the Kukenaam River. Thence a march of $1\frac{3}{4}$ hours through flat savannah land up the left bank of the river brought us to Kamaiwawong, the village from which we proposed to make our ascent of Mount Roraima.

Kamaiwawong takes its name from the Kamaiwa, a stream which, after a vertical leap of some 1000 feet from the point on Roraima where the ledge ascending the cliff-face reaches the summit of that mighty wall, flows past the village, between it and Tekwonno, to join the Kukenaam River. This larger river curls out from behind the south spur of Mount Kukenaam

and makes its way through a gap between low savannah hills into the valley which our trail had traversed. On the east the little plain of Kamaiwawong, 3700 feet above sea-level, is bounded by the Towashing, a much larger stream, also a confluent of the Kukenaam River, but taking its rise near the detached pinnacle which forms the southernmost corner of Mount Roraima. . . . Both mountains rise from the same pediment of savannah hills surmounted by forest which, though rising to a height of 3000 feet above the village, are completely dwarfed and dominated by the immense cliffs towering over them. The whole scale is so huge that eyes unaccustomed to it are easily deceived as to the distances involved. The cliffs seem within easy reach, whereas they are really not less than 4 miles off in the direct line of vision at the nearest point. The ledge by which Mr. (now Sir Everard) im Thurn first cut a path to the cliff top can easily be seen from the village—a line of green across the red face of the rock.

The scene when one has at last scaled the cliff-face of Roraima is fantastic and almost grotesque. Little meets the eye save rock which the weather has blackened and worn into many weird shapes,—a dragon, a frog, and a couple of umbrellas, all of rock, were conspicuous objects at the point where we camped for the night: but there is in general a monotonous lack of differentiation in the rock-shapes, making this rugged plateau a maze where one would soon be lost, especially if mist settled down on the mountain . . . Here and there are stunted trees (*Bonnetia Roraimæ*). Water is abundant, clear as crystal and icy cold.

From one point we obtained a good view of the top of Mount Kukenaam, which appeared to be the same fantastic jumble of black weather-worn rock that surrounded us where we stood. Neither mountain seems at all suitable for human habitation in spite of the invigorating climate at this high altitude, 8630 feet above the sea. From the cliff-edge the panoramic view to the south-west is superb, though the charm of the scenery is greater when one is lower down the mountain . . . On the western horizon, many miles away, stood out two vast Venezuelan mountains, which even Roraima seemed powerless to dwarf, both apparently cliff-faced and flat-topped like the twin giants which guard the frontier of British Guiana.

Weitipu is one of the giants of this country, set as a landmark between Brazil and Venezuela. The mountain seems to be made of quartz, cliffs of which stood out where the savannah slopes had been washed away. Its southern end is roughly circular at the base, the sides being terraced and the small plateau at the top being surmounted by a sharp peak, which affords an uninterrupted view to every point of the compass. All this part of the mountain is savannah with occasional tree-clumps and is seamed by the channels of small streams tumbling from its terraces in sparkling waterfalls. To the northward the mountain is forest-clad and is shaped

into the cliff-sided, flat-topped rectangular block, which is so characteristic of this country. From its north-east side stretches a sea of forest, in which two crags jut out fantastically, side by side, the more conspicuous of the two being known as Mukoripo. Weitipu is a very attractive mountain, majestic, but without the bleak austerity of Roraima and Kukenaam. Its southern summit would afford a splendid camping-ground and several of its terraces would make beautiful house-sites. In China such a mountain would have been studded with temples and monasteries.

To sum up, the outward journey between Mataruka and Kamaiwawong by Joseph's trail was a march of 32 hours and 47 minutes; and the return journey between the same villages by Schoolmaster's trail was a march of 32 hours and 51 minutes, of which 11 hours and 28 minutes were occupied in retraversing those parts of the route where the two trails were identical, namely, the Kukenaam valley, the ascent from the Kotinga ford to landmark peak, and the line from Rera to Mataruka. There is little to choose between the two routes. Both mean five stages of rather more than six hours' march a day. Schoolmaster's line was slightly more direct, but Joseph's line was appreciably less arduous.

The route which, as the result of our experience, I would recommend to the future traveller from Chenapowu to Roraima would coincide with our own from Holmia to the north boundary of Mr. Menzies' tableland. This section can be accomplished, given adequate transport, in three days. Thence it is, according to Joseph, two days' march *viâ* the headwaters of the Chiung River to Enamung, and from Enamung it is four stages to Kamaiwawong. The whole distance could therefore be covered in nine days' march by the line southward of Mount Kowatipu. Now the record for expeditions travelling over the trail from Chenapowu to Kamaiwawong running north of Mount Kowatipu *viâ* Saveretik is held, I understand, by Dr. Crampton, who, believing his life to be threatened by Jeremiah, the late chief of the Arekunas at Kamaiwawong, accomplished the return journey in eight days of actual marching. The general profile of the country traversed by him between Roraima and Kaietuk is shown on a diagram published in *Timehri*, and for the sake of comparison I have drawn a similar profile of the country traversed by us. The balance of advantage appears to lie with the southerly route, for (*a*) it involves only two days of forest travel; (*b*) it affords an opportunity of visiting the high-level savannahs of this colony; (*c*) it passes through a region in which both the Makusis and the Arekunas have numerous banaboos, and consequently (*d*) there is no fear that food supply or means of transport will be insufficient.

Under existing conditions, good organization and fine weather will always be essential to the success of a journey from Georgetown to Roraima. Good organization we had, thanks to Mr. Menzies' experience, for he is

persona grata among the Makusis, who have known him for years, who have confidence in him, and were most hospitable and friendly to us on

that account. The weather also favoured us; and I do not think that any season of the year is likely to be better suited for this expedition than the months of December and January. Unfortunately the journey is an expensive one; but that is a fault which will be cured as soon as this colony takes a practical interest in the development of the high-level savannahs of the interior. The heavy expenses are all incidental to the river journey up the Potaro. In the savannah country, the cost of transport is at the rate of one shilling a day for each drogher. A party such as ours, in order to travel rapidly, needs about twenty droghers, whose wages would therefore total £1 for each day's march. According to the custom of the country, days spent at rest in camp are not paid for.

ROUTES IN KAN-SU.

Eric Teichman, B.A.

Map, p. 520.

THE following notes accompany a route map of Kan-su Province which I have recently compiled during my spare time from full notes made during an extended tour in that province in connection with the investigation of opium cultivation and other matters. As the journey was made with the assistance of the Chinese officials I had quite exceptional opportunities of going wherever I pleased, and covered practically the whole province except the extreme west.

The map does not pretend to be geographically accurate, but was drawn up to accompany an official report on the journey. I found the existing foreign maps of Kan-su singularly unreliable away from the main Peking-Turkestan road. I have therefore compiled the accompanying map from my own notes and from Chinese maps, which I found more reliable than the foreign ones. The Kan-su sheet of the China Inland Mission atlas of 1906 was about the best of the latter, but even it is full of remarkable inaccuracies, such as the position of the two Tao Chous in the south-west, the Koko Nor border north of the Si-ning, and the rivers between Ping-liang and Ning-Hsia Fu.

The names given are all Chinese. Many places have Tibetan and Mongolian names also. The map was made as follows:—

I kept up a route survey with a prismatic compass all the way with the exception of a very few days when special circumstances did not permit of my doing so. I then fitted my routes into a map of the Province which I had compiled from Chinese maps. The Chinese information is more reliable than that on foreign maps, especially that obtained from the district magistrates. The existing foreign maps of Kan-su seem to be made up of a collection of the routes of the old Russian travellers with weird place-names which the local Chinese have never heard of.

The road from Sian in Shen-hsi to Lan-chou Fu, 470 miles—a portion of the great highway from China to Turkestan—is too well known to need description. After leaving the Shen-hsi frontier and crossing the Liu-pan-shan pass (about 9000 feet), it traverses the loess plateau of north-eastern Kan-su for the rest of the way to Lan-chou Fu, winding through a maze of loess hills, valleys, and ravines. It is not a very pleasant journey, as all this region suffers from deficient rainfall, and the inhabitants are miserably poor, supplies very scarce, and the drinking-water often brackish. The loess plateau of central and north-eastern Kan-su, here 5000 to 7000 feet above the sea, slopes northwards from the mountains buttressing the Koko Nor down to the deserts of Mongolia, becoming more and more arid as one proceeds north till it merges into the sands of the Ordos and the Alashan. It is composed of a covering of loess, in places hundreds of feet thick, lying on sandstone, shale, and limestone, of which there are various outcroppings in the form of mountain ranges trending in a south-easterly direction from the Huang Ho (Yellow River). Where water is available the loess is highly fertile, as in the green irrigated valleys near Lan-chou Fu and the Huang Ho. It is a treeless region, and it is doubtful whether it was ever forested to any great extent; in its present condition the loess seems incapable of producing trees. On the map this distance is less than 200 miles, but allowing for mountains and windings it may be much more.

From Lan-chou Fu we proceeded south-east to Ch'in Chou, 240 miles, which is also a well-known trade route. The road, a good cart track for Kan-su, crosses a small pass to gain the Tao River valley and Ti-tao Chou, traverses the watershed between the Tao and Wei River valleys, and descends the latter to Ch'in Chou. Here, where the loess meets and mingles with the red sandstone of the Tsin-ling Shan range, is a much more fertile and better-watered region; good crops are raised even on the hills, and the people are better off.

From Ch'in Chou we travelled west through Li Hsien and Min Chou to T'ao Chou and Labrang monastery on the Kan-su Koko Nor border, a distance of about 300 miles. Between Ch'in Chou and Li Hsien the path crosses the Tsin-ling Shan, and passes from the basin of the Huang Ho into that of the Yang-tse by an easy pass. The south-eastern corner of Kan-su, south of the Tsin-ling Shan range, differs greatly from the rest of the province. The bare loess hills of Central Kan-su with their waterless valleys give way to jungle-covered mountains with abundance of water, and coolie transport takes the place of camels, carts, and mules. The people are in close touch with Se-chuan, and there is a considerable element of the latter province in the population and a noticeable absence of Mahomedans, who are so strong and numerous in other parts of Kan-su.

From Li Hsien to Min Chou the path is a bad mule track along the Tsin-ling Shan, first on one and then on the other side of the watershed, winding

through narrow cultivated valleys hemmed in by wooded mountains where the cornfields swarm with pheasants. Gradually rising it emerges before reaching Min Chou on to a grassy plateau some 9000 feet high, the extreme western end of the Tsin-ling Shan, which here merges into the mountains of the Koko Nor border. From this plateau there is a steep descent to Min Chou in the valley of the T'ao River.

From Min Chou we ascended the T'ao River valley, a deep trough in the mountains, to T'ao Chou New City, Cho-ni, and T'ao Chou Old City. New and old T'ao Chou lie a little way north of the T'ao River in a region of bare hills of red clay and red sandstone which occur all along the border; the whole region is comparatively elevated, 8000 to 9000 feet above sea-level. New T'ao Chou (so called though it is some hundreds of years old) is the official city as opposed to Old T'ao Chou, the commercial city where the Chinese, mostly Mahomedans, are engaged in trade with the surrounding Tibetans. Cho-ni, a picturesque little place, lies right on the river, which is here crossed by a remarkably good cantilever bridge, and is little more than a walled village round the residence of the "tu-ssu" (native chief); there is also a lama monastery with some five hundred lamas. The T'ao River is in this neighbourhood the dividing line between Tibetan and Chinese populations; south of the river are forest-clad mountains with a Tibetan population; to the north are the red hills with cultivated valleys inhabited by Mahomedan Chinese. Some of the best big-game shooting in China (sheep, wapiti, serow, etc.) is to be had in the forests south of the T'ao River in this neighbourhood. From various points in the vicinity of T'ao Chou fine views are obtained over the rocky snow-patched Min Shan range to the south of the T'ao River on the Kan-su Se-chuan border, a forbidding-looking barrier with a singular square gap known as the "shihmen" (stone gate), through which lies the road to Sung-pan in Se-chuan, a difficult route to travel by owing to the turbulent nature of the intervening Tibetans.

Leaving T'ao Chou Old City on the Labrang road there is a gradual rise to the grass lands of the Koko Nor plateau 10,000 to 11,000 feet above sea-level, inhabited by nomad Tibetans (Drokba) living in black tents. The grass lands ("tsao-ti," as the Chinese call them) are dotted with herds of yak and ponies and flocks of sheep, and antelope are occasionally seen. The track passes from one shallow grassy valley to another, and then descends slightly to the large monastery of Hei-tso (one thousand lamas), where cultivation reappears. At Hei-tso the track leaves the grass lands and winds through picturesque forest-clad valleys, crossing and recrossing mountain torrents for two more days to Labrang, which like Hei-tso lies in a shallow cultivated valley (about 9000 feet) just below the level of the grass lands. Labrang (Chinese La-ba-lang-ssu) contains over three thousand regular lamas as well as a large floating population of visiting Tibetans, and is the most important religious centre of the Koko Nor, not excepting Kumbum. It is a regular town in itself, and the

solidly built barrack-like buildings and huge gilt-roofed temples present a most striking appearance in this land of tent-living nomads. Near by is a small Chinese trading village consisting of inns and bazaars kept by Mahomedans; for Labrang, like all big lama monasteries on the Chinese border, attracts trade. Labrang is nowadays comparatively well known to foreigners.

From Labrang to Ho Chou is three days' journey down the densely wooded gorge of the Ta-hsia River. The mule track is bad, and dangerous in places where it is ledged out of the cliff side or carried on plank stagings overhanging the torrent, but there is nevertheless a constant stream of mules carrying goods up and down for the Mahomedan merchants. Ho Chou is a pleasant little city lying in a fertile valley some 6000 feet high surrounded by rocky snow-sprinkled mountains. It is of interest as the home of the Sala Mahomedans, and many of the inhabitants show their Central Asian origin in their long narrow faces, large eyes, and strong and often curly beards. A knowledge of Turki survives in the neighbourhood. From Ho Chou it is three days' journey across two mountain ranges and the T'ao River (crossed by a ferry) to La Chou Fu.

Leaving the provincial capital for the second time we followed the great west road as far as Liang-chou Fu, whence we struck north to the small town of Chen-fan Hsien on the edge of the Alashan desert, a distance of about 250 miles. For the first few days out of Lan-chou Fu the road passes through a barren waterless region with rare and brackish streamlets, whence it emerges into the fertile valley of the P'ing-Fan River. This valley is followed for two and a half days, past the small city of P'ing-Fan Hsien to the Wu-shao Ling (about 10,000 feet). The flat marshy valley of the upper P'ing-Fan River, the ruins of the Great Wall and of Chinese forts and military posts, and the background of bare snow-capped mountains combine to make up a scene of peculiar desolation which has witnessed many struggles between Chinese, Mongols, and Mahomedans in the past. Crossing the Wu-shao Ling, where marmots chase one another over the grassy slopes, the road descends gradually to the Liang-chou Fu plain. This pass represents the watershed between the Huang Ho and the Central Asian basins, and the streams flowing north lose themselves in the sands of the desert and fail to reach the sea.

Liang-chou Fu is a large city in a fertile irrigated plain between the Nan Shan Mountains and the Alashan desert. Immediately to the west rises a gigantic snow-mass in the main range of the Nan Shan, which provides water for the innumerable streamlets and irrigation channels fertilizing the oases in the plain till they are used up and disappear in the desert. These oases, of which Chen-fan Hsien three days north of Liang-chou Fu is the most important, are regions of great fertility, where cloudless summers combined with a never-failing supply of snow water for irrigation purposes ensure full crops with machine-like regularity. A feature of these irrigated plains are the fortified farmhouses with which every oasis is thickly dotted;

villages, so prominent a feature of the country life of China, are conspicuously absent. These fortress farms, which are in a lesser degree characteristic of many parts of Shen-hsi and Kan-su, are the result of the feeling of insecurity engendered by the Mahomedan rebellions of the past. The population of these plains is entirely Chinese.

From Chen-fan Hsien to Si-ning Fu and the Koko Nor border there are two roads, to the south and north of the snow mountains behind Liang-chou Fu respectively. We took the latter, *viâ* Yung-ch'ang Hsien, Epo, and Ta-tung Hsien. From Chen-fan Hsien to Si-ning Fu by this route is about 330 miles.

The three and a half days' journey from Chen-fan Hsien west to the district city of Yung-ch'ang Hsien is a trying march through waterless desert, especially for the first 30 miles which lie across heavy sanddunes. The Alashan desert is a forbidding waste of sand, lifeless except for antelope, which are constantly in view; the wells are rare and very brackish, but sweet water can be carried. As Yung-ch'ang Hsien is approached the country improves, and west of that city we travelled for three days over a grassy plain below the main range of the Nan Shan till we struck the Si-ning Fu–Kan-chou Fu trail at the mouth of the gorge leading through the mountains up to the Koko Nor plateau. Here were fine pasture lands with grass up to the ponies' knees and many antelope (altitude 8000 to 9000 feet). This country is inhabited by Chinese, but the population is very scanty, and cultivation limited to a few stunted crops of huskless barley round the ruined Chinese military posts. From the mouth of the gorge (known as the Pien-tu-k'ou—"frontier crossing pass," as it leads over the Kan-su border to the Koko Nor) to the little trading station of Epo is a long day's journey, made the more difficult by the mountain torrent which is barely fordable for loaded mules. The track is a very rough one, though this gorge represents an important trade route, being one of the few trails from Mongolia to the Koko Nor through the Nan Shan passable for camels. As the head of the gorge is approached the steep rocky mountain sides give way to grassy downs, and the traveller finally emerges after crossing an easy pass into a flat grassy valley at a height of about 11,000 feet dotted with the black rectangular tents of the Koko Nor Tibetans and innumerable flocks of sheep; an occasional Mongol yurt is also to be seen, for these steppes are inhabited by Mongols as well as Tibetans. The walled village of Epo lies surrounded by a sea of grass on or just across the Kan-su–Koko Nor border; the garrison of Chinese braves has now been withdrawn, but a small Mahomedan community remains engaged in the Tibetan trade and more especially in the purchase of wool, for this is a great sheep country.

From Epo the track runs due south across another easy pass, whence there is a fine view over the reverse side of the snow giants behind Liang-chou Fu, and descends to Yung-an in the valley of the Ta-tung River; from here it continues down the valley over a grassy plain some miles across bounded on either side by mountain ranges to Pei-ta-tung, where a little

scanty cultivation makes its appearance again. Yung-an and Pei-ta-tung are replicas of Epo; each of these old military posts is a long day's journey from the next without habitation in between.

At Pei-ta-tung the Ta-tung River, a broad and very rapid stream, is crossed by the usual "pifatzu" (a raft composed of a light framework resting on inflated skins), the animals having to swim, and the road leaving the valley climbs abruptly up the formidable range known as the Ta-pan Shan. Both ascent and descent are very steep, and the path particularly bad and rocky. The summit of the pass (about 13,500 feet) is just below the snow-line in August. From the Ta-pan Shan the track descends through narrow valleys to the district city of Ta-tung Hsien (Maopeisheng), which lies at a much lower altitude in a grain-growing region of cultivated valleys inhabited by Mahomedans. From Ta-tung Hsien to Si-ning Fu is a day and a half's journey by a good road down the valley of the Pei Ch'uan.

Si-ning Fu, one of the principal cities of Kan-su, is too well known to need description. It lies surrounded by bare mountains in a small plain formed by the conjunction of three streams, the Pei Ch'uan (from Ta-tung), the Hsi Ch'uan (from Tan-ko Hsien), and the Nan Ch'uan (from Kumbum monastery). From Si-ning Fu to Lan-chou Fu by the short road down the Si-ning River is six days' march (148 miles). The path is a bad and in places rather dangerous mule track down the gorge of the Si-ning River; the hills are bare sandstone covered by a layer of loess, and the country becomes more and more arid as one proceeds east, until the desolate hills and irrigated valley of the Huang Ho are reached one day above Lan-chou Fu.

From Lan-chou Fu we returned to Peking by the Huang Ho route. Rafts or boats are obtainable at Lan-chou Fu, but both are scarce. The former are safer for the stretch of 200 miles or so as far as Chung-wei Hsien, as the Huang Ho here runs through mountain gorges rivalling those of the Upper Yang-tze, and is much obstructed by rock and rapids. We were fortunate in securing large rafts of piled-up lumber standing a foot out of the water, and with a good tent pitched on the top there are few pleasanter methods of travelling in China. Navigation is carried out by large sweeps at the bow and stern, and consists in keeping the raft in the centre of the stream and away from the cliffs and rocks in rounding the bends of the river. The worst rapids occur immediately below Lan-chou Fu, and this stretch of gorges come to an end at Po-wan, half a day above the district city of Ching-yuan. In this neighbourhood the red sandstone cliffs bounding the river are pocked with square caves resembling those on the Min River below Cheng-tu in Se-chuan. Some are inhabited and provided with ropes and ladders as a means of access, though it is strange that any one should want to live halfway up a perpendicular cliff overhanging the river. Between Ching-yuan Hsien and Chung-wei Hsien the river runs through a series of gloomy gorges in desolate mountains of sandstone and shale; rapids are numerous, some of them sufficiently

alarming. Goral (wild goat) are seen in quite extraordinary numbers in these gorges, especially in the evenings, clambering about the precipitous cliffs. The stretch from Lan-chou Fu to Chung-wei Hsien takes about five days, night travel not being possible.

At Chung-wei Hsien, a considerable city, where the Huang Ho emerges from its mountain gorges on to a broad alluvial plain, we abandoned our rafts for boats, since the river is here much obstructed by sandbanks, and the unwieldy rafts are constantly running aground. Passing through the famous Ning-hsia plain, a region of great agricultural wealth due to a complicated system of irrigation from the Huang Ho, the city of Ning-hsia is reached, and two days further on the Kansu border is crossed and the dreary wastes of the Ordos are entered, where for days one sees no signs of life save for the desert antelope and an occasional Mongol with his camels. In the neighbourhood of the San-ta-ho-tzu (where there is a Roman Catholic Mission) the country on the north bank improves, and a considerable Chinese population is found engaged in agriculture round the old branches of the Huang Ho; to the south the country remains desert. Millions of geese frequent this portion of the Huang Ho in September. The length of time taken over the journey through the Ordos depends very much on the wind, as with an adverse wind, or indeed any wind at all, the clumsy scows are constantly blown ashore. Strong winds are naturally frequent in these regions by day, but night travelling is often possible. Twenty-four hours (floating time) above Pao-t'ou the Wulashan Mountains are reached, a rocky range stretching along the north bank, and a prominent landmark from afar. From this point on the population increases until Pao-tou is reached, where the country is one vast cornfield.

From Pao-t'ou to Kuei-hua-ch'eng is four days by a good cart road across undulating grain-growing prairies just south of the Ta-ching Shan, a continuation of the Wu-la Shan. From Kuei-hua-ch'eng to Feng-chen, the present railhead of the Peking Kalgan Extension Railway, is also four long days' march by a good cart road through low mountains.

THE PHYSICAL CONDITIONS OF THE WEDDELL SEA.

R. G. Mossman, F.R.S.E.

Read at the Afternoon Meeting, 15 *June* 1916.

This paper was prepared originally for the guidance of the Committee appointed by the Admiralty to conduct the search for and relief of the Shackleton Expedition overdue from the Weddell Sea. Before it was delivered Sir Ernest Shackleton reached the Falkland Islands, and the questions of immediate interest to the meeting were the hope of survival and

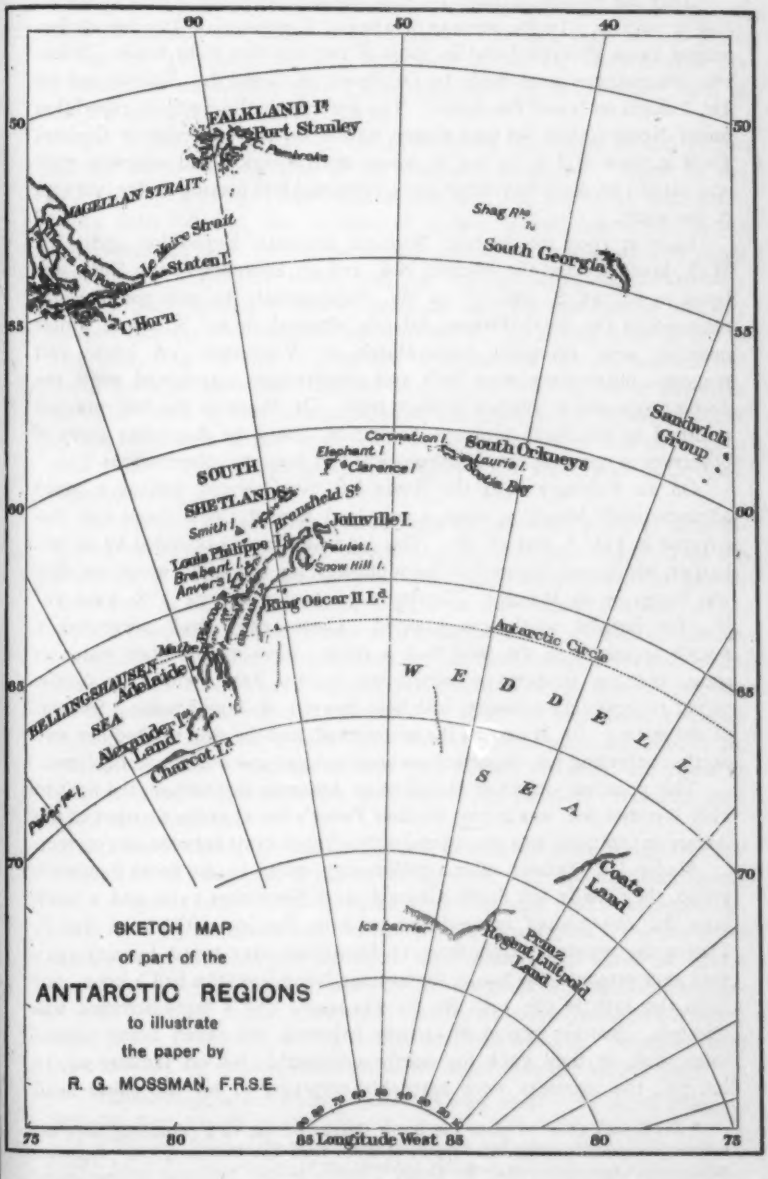
possibilities of rescue for the company on Elephant Island. Favourable speculations on these questions having been justified in the result, and with the prospect of an early authoritative account of the voyage, the author has eliminated those parts of this paper which were only of temporary interest; the remainder stands as a summary of our knowledge of the Weddell Sea up to the date of the latest expedition.

Ed. G. J.

THE Weddell Sea, which the discoverer himself named "King George IV. Sea" in honour of his reigning Sovereign, was successfully explored in February 1823, when, profiting by fair winds and (in the light of modern experience) a phenomenally open season, Weddell attained the latitude of 74° 15′ S. in the longitude of 34° W. Here on February 20 there was no ice in sight save three small bergs; but owing to a fresh southerly breeze and the lateness of the season, further progress towards the Pole was hazardous, and Weddell was compelled to return, having attained the then "farthest south," 214 nautical miles nearer the Pole than Captain Cook. This was a remarkable voyage, especially when we consider that it was made in a small brig, the *Jane*, a sealer of 160 tons, accompanied by a cutter, the *Beaufoy*, of 65 tons, ill adapted to withstand the perils of ice-encumbered seas.

Tempted by Weddell's success other explorers were not slow to try the "open sea" route to the Pole, but no good fortune attended their efforts. When the French explorer Dumont d'Urville, in January 1840, attempted to follow Weddell's route, impenetrable pack-ice stopped him in 64° S., 615 nautical miles to the north of the record latitude. Ross, three years later, had no better fortune, encountering a continuous line of pack-ice from Louis Philippe Land eastward, while an agglomeration of ice-floes presented through hundreds of miles an effectual barrier to his southern progress. He crossed Weddell's track in 65° 13′ S., and a few days later found the pack-edge turning towards the south. On March 5, when in lat. 71° S., long. 16° W., at a short distance from the pack-edge, he was surprised by a hurricane from the north-east, the heavy seas rolling in on the ice presenting the appearance of a foaming line of breakers. Fortunately, after two days' incessant labour, the *Erebus* and *Terror* were able to beat off, and the danger of being cast on something worse than a lee shore was over.

These early voyages, although of considerable interest, provided few scientific data beyond meteorological observations taken during summer and early autumn in positions that were constantly varying. It is however worthy of remark that Weddell noted (Weddell, 'A Voyage Towards the South Pole' (London, 1827), p. 33) that the direction of the surface currents showed a strong set to the north-west to the south of the Antarctic circle, but that in the lower latitudes of 64° to 65° S. on the meridian of 40° W. the drift changed to the east. This is quite in harmony with the results obtained from recent expeditions.


60
50
40
50
FALKLAND Is
Port Stanley
Pembroke
MAGELLAN STRAIT
Le Maire Strait
Staten I.
C. Horn
Shag Rks
South Georgia
55
55
Sandwich Group
Coronation I.
South Orkneys
Elephant I.
Clarence I.
Laurie I.
SOUTH SHETLANDS
Bransfield St.
Smith I.
Joinville I.
Louis Philippe Ld.
Brabant I.
Anvers I.
Faulet I.
Snow Hill I.
King Oscar II L.d
60
60
Antarctic Circle
Mathew
BELLINGSHAUSEN SEA
Adelaide I.
Alexander Ld.
Charcot I.s
W E D D E L L
S E A
65
65
Peter Ist I.
70
70
Coats Land
Ice barrier
Prince Regent Luitpold Land
SKETCH MAP
of part of the
ANTARCTIC REGIONS
to illustrate
the paper by
R. G. MOSSMAN, F.R.S.E.
75
80
85 Longitude West 85
80
75

After the voyage of Ross no expedition entered the Weddell Sea for half a century. In the summer of 1892–3 a number of Dundee whalers visited Louis Philippe Land in quest of the southern right whale. Scientific observations were made by Dr. Bruce on board the *Balæna*, and by Dr. Donald on board the *Active*. Ten years later the Swedish expedition under Nordenskjöld set up a winter station on the east coast of Graham Land at Snow Hill I., 64° 22′ S., where meteorological and magnetic work was carried on until November 1903, Nordenskjöld making sledge journeys to the south.

Early in 1903 the Scottish National Antarctic Expedition under Dr. W. S. Bruce entered the Weddell Sea, and on February 22 the *Scotia* was beset in 70° 25′ S. and 17° 12′ W. Subsequently the ship got free and returned to the South Orkney Islands, situated in 61° S., where winter quarters were occupied from March to November. A house and magnetic observatory were built and observations maintained, while the *Scotia* proceeded to Buenos Aires to refit. Dr. Bruce in the late summer returned to the South Orkneys, having on board an Argentine party of observers to continue the meteorological and magnetic observations.*

On 22 February 1904 the *Scotia* left the Orkneys, making a rapid advance until March 3, when a new land named Coats Land was discovered in 71½° S. and 18° W. This land was mostly bounded by an ice-barrier, which was followed to the south-west for 150 miles, where the ship was frozen in on March 7. During a blizzard in lat. 74° 1′ S., long. 22° W., the farthest south was attained. Close heavy pack prevented a nearer approach to the land than 2 miles; there was no open water in sight, and the temperature was down to zero Fahr., while the *Scotia*, owing to heavy ice pressure, had been heaved up bodily some 4 feet out of the water. On March 13 the ice opened, and the ship worked her way north, continuing her important oceanographical and other investigations.

The principal object of the German Antarctic Expedition, the next to visit Weddell Sea, was to test whether Penck's theory of the division of the Antarctic continent into two masses with a frozen strait between was correct.

Under Dr. Filchner, after a preliminary cruise to the South Sandwich group, they finally left South Georgia on 8 December 1911, and a week later the *Deutschland* entered the pack in the low latitude of 59° S. During the twenty-six days from 15 December 1911 to 10 January 1912 very slow progress was made, the average being less than half a knot; but from the 11th to the 14th the ice was open, and a rapid advance was effected. Another period of anxiety followed, the vessel being almost immovable in tight pack for nearly a fortnight; but on January 29, in lat. 75°, the mariners were agreeably surprised to see the ship's head

* Dr. Bruce's effort to place the South Orkney station on a permanent basis was rendered successful through the support obtained from Dr. Escalante, then Argentine Minister of Agriculture, Mr. W. Davis, Director of the Argentine Meteorological Service, and Dr. Francisco P. Moreno.

bowing to the swell, the "land water" characteristic of the lee side of Antarctic continental areas being in sight. The ship then worked south to lat. 77° 45′, long. 34° 40′, and found barrier ice much broken up. Attempts to establish a station were frustrated by the breaking away of the ice, and a retreat was inevitable.

On March 8, in lat. 74° S., the *Deutschland* was frozen in and drifted all the winter, a plaything of the wind and currents. Urged by the east winds prevailing in high altitudes the drift was first to the west-south-west; then followed four months of a drift almost due north on the meridian of 44° W. In September the prevailing south-south-west winds gave place to westerly winds, and the current drove the *Deutschland* east. After pursuing an erratic northerly drift for two months the ship worked free on 26 November 1912, in lat. 63° S., having been frozen in 263 days. At the end of June Dr. Filchner and two companions had made a sledge excursion from the ship to the west to see if any trace could be found of the debated Morrell Land, which the American sealer of that name said he had discovered in 1823, but which had never been seen since. This sledge party were away eight days, and came back without having seen land.

Dr. Filchner's expedition returned with an important series of meteorological, oceanographical, and biological investigations. Apart from the discovery of new land the drift of the ship demonstrated the general circulation of the air and ocean currents of the Weddell Sea area, which entirely corroborated the scheme of atmospheric and oceanic circulation deduced from the observations taken on the *Scotia* some years previously, while the new land forming the southern boundary of the Weddell Sea was found exactly in the position calculated.* It will be some time yet before the important scientific results of Sir Ernest Shackleton's Expedition are available. Their co-ordination with data already discussed will probably modify in some directions the synopsis of the physical conditions now under consideration.

Our knowledge of the various physical factors operating in the Weddell Sea area is very unequal, as was to be expected. Meteorology bulks large, while a good deal of hydrographic work has also been accomplished, particularly by the *Scotia* and the *Deutschland* expeditions. On the other hand, apart from the very complete land observations taken at Laurie Island and Snow Hill I., comparatively little magnetic work has been accomplished, and there is here a profitable field for the employment of a research ship like the *Carnegie* operating in high southern latitudes. In our attempt to summarize the existing information we begin with the Meteorology.†

* "Meteorology in the Weddell Quadrant during 1909." By R. C. Mossman. *Scott. Geo. Mag.*, vol. 26, 1910, p. 417.

† A full description of the meteorology of the area under consideration is given in my memoir on "The Meteorology of the Weddell Quadrant and Adjacent Areas" (*Trans. Roy. Soc. Edin.*, vol. 47, pp. 103–136) the essentials of which have been but slightly modified in the light of later observations.

Isobars and Prevailing Winds.

The general atmospheric circulation is shown in the annexed diagram (Fig. 1), which gives isobars and prevailing winds for February and March representative of the late summer, and of June and July the winter months.

It will be seen that in the region to the west and east of Cape Horn two "centres of action" are indicated. The one to the west over the Bellingshausen Sea is centred just about in the latitude of the Antarctic

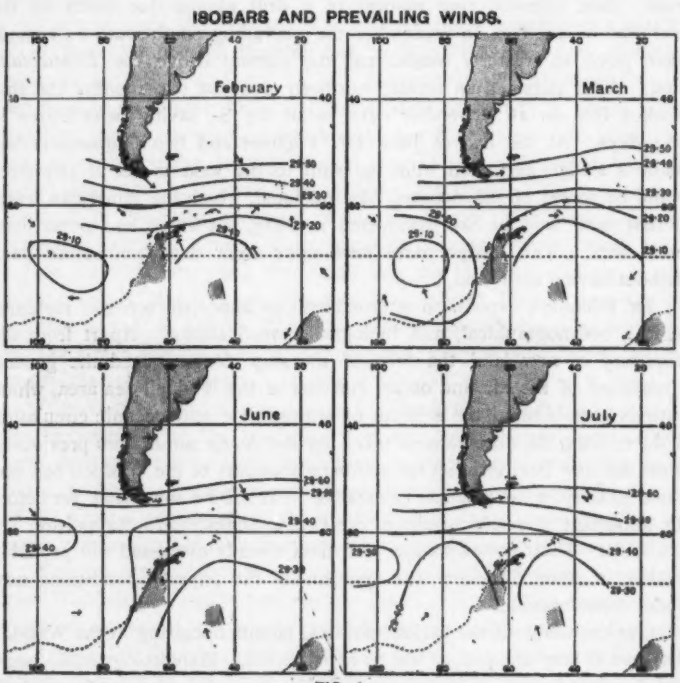


FIG. 1.

Circle; that over the Weddell Sea, which largely controls the conditions at the South Orkney group, is located a little further south. Over the South of Graham Land an area of relatively high pressure is shown. There is thus a wind divide which places the region east of Graham Land under the control of Atlantic influences, while to the west of Graham Land the circulation is dominated by the cyclonic centre located about 100° W. The boundary-line is approximately the 60th meridian of west longitude from lat. 68° to 60° S. or down the centre of Graham Land. On reaching the southern extremity of the South American continent the boundary-line has changed to 70° W., so that places to the west of this line up to about

lat. 30° S. are strongly dominated by Pacific influences, the Andean chain forming a natural division between the Atlantic and Pacific air circulations. On the Pacific side of Graham Land strong north-east winds prevail south of lat. 62° S., and further to the west in about lat. 70° S., long. 82° to 99° W., as shown by the *Belgica* observations, the winds are monsoonal, easterly in summer and westerly in winter. On the west side of Graham Land, as shown by various explorers, away from land in a mean position 64° S. long., 55° W. winds in summer are evenly distributed round the compass. At Paulet Island and Snow Hill I. in the same area the prevailing wind is south-west, at the South Orkneys west-south-west, at South Georgia west-north-west; while further east and south-east about the meridian of Greenwich, south of lat. 60° S., strong easterly or north-easterly winds are met with

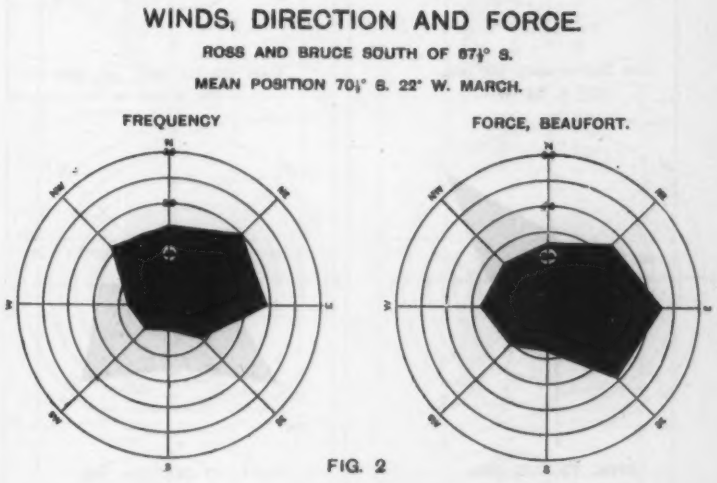


FIG. 2

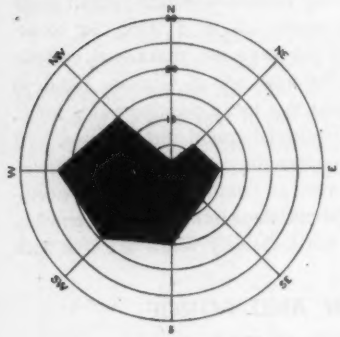
(see Fig. 2), which in summer and early autumn on the meridian of 35° W. prevail up to lat. 78° S., as shown by Filchner's observations and those made on the *Endurance*.

On the western side of the low-pressure area the mean wind is about south-south-west, the combined mass of observations indicating a general circulation round the Weddell Sea. This circulation is also confirmed by the drift of the *Endurance* (see Fig. 3).

In Fig. 4 the effect of this circulation on the isotherms is shown for the months of February and March, for which months the greatest amount of information is available, and for June and July, the coldest months. The lines of equal temperature are drawn for intervals of 5° Fahr. for the two former; but for the two later months the lines represent intervals of 10° Fahr.

WIND FREQUENCY "DEUTSCHLAND 1911-1912."

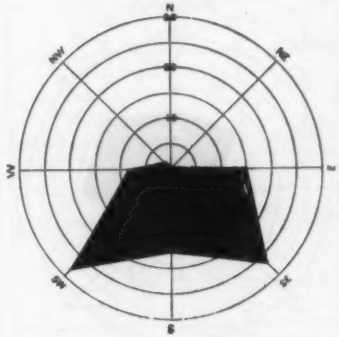
DEC. 17th, 1911 TO JAN. 10th, 1912.
62° S. 31° W.



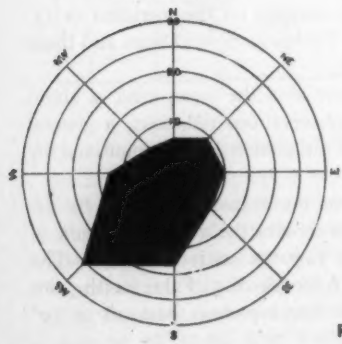
JAN. 13th TO 29th, 1912.
72° S. 28½° W.

JAN. 30th to MAR. 4th, 1912.
77¾° S. 34° W.

MAR. 6th TO MAR. 31st, 1912.
73° S. 34° W.



APRIL TO AUG. 1912.
70° S. 42½° W.



SEPT. TO DEC. 16th, 1912.
64° S. 38° W.

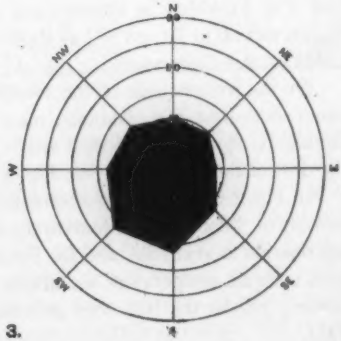


FIG. 3.

It will be seen that a cold area lies in the vicinity and to the south and west of Snow Hill I., Nordenskjöld's station. The relatively milder climate that prevails on the west as compared with the east side of Graham Land is due to the prevalence of the relatively warm north-east winds just referred to. The cold Antarctic current which sweeps down the east side of Graham Land appears to pass to the east of, but sometimes surrounding, Elephant Island, causing the isotherms to bend to the north in harmony with the northern limit of the ice-stream. The oscillations of the northern

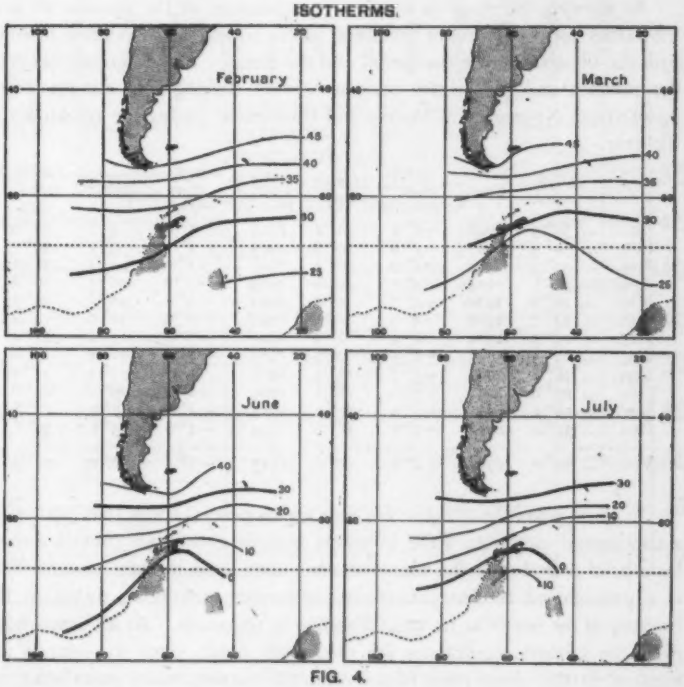


FIG. 4.

limit of the pack ice from season to season are very wide in the Weddell Sea area, and these profoundly influence the climatic conditions.

The annual temperature variation in most temperate and tropical regions is covered by well-defined factors which are more or less constant from one year to another; but at the South Orkneys the presence or absence of pack-ice around or in close proximity to these islands causes great variations in the mean monthly, seasonal, and even annual temperatures. The striking difference that prevails between the mean annual temperature of the South Orkneys and of South Georgia, some 380 miles

to the north-east, is shown by the circumstance that, during the six years 1905 to 1910, while the mean annual values at the South Orkneys varied from 23°·1 to 26°·6 a range of 3°·5; at South Georgia the difference was only 0°·5, and at Cape Pembroke, Falkland Islands, 1°·1. These pronounced differences are almost wholly occasioned by the greater variability of temperature at the South Orkneys during the autumn and winter months, since from November to March there is little change from one year to the next in the mean temperature, owing to the comparatively open ice conditions.

As showing the range in the mean temperature of the months we give the values corresponding to the mean of the warmest and coldest months, with the departure from the mean, and the range. The difference between the summer and the winter months is very striking, the climate being insular from November to March, and continental during the remainder of the year.

	Highest temp.	*Year.*	*Diff. from mean.*	*Lowest temp.*	*Year.*	*Diff. from mean.*	*Range.*	*Mean 1903–1914.*
Jan. ...	33°·9	1906	+1°·9	30°·2	1913	−1°·8	3°·7	32°·0
Feb. ...	34°·5	1907	+1°·8	30°·6	1905	−2°·1	3°·9	32°·7
Mar. ...	32°·7	1910	+1°·6	28°·5	1913	−2°·6	4°·2	31°·1
April ...	31°·1	1914	+4°·7	20°·6	1903	−5°·8	10°·5	26°·4
May ...	26°·8	1910	+6°·7	10°·5	1904	−9°·6	16°·3	20°·1
June ...	22°·7	1910	+8°·3	6°·1	1913	−8°·3	16°·6	14°·4
July ...	17°·5	1910	+6°·4	2°·3	1905	−8°·8	15°·2	11°·1
Aug. ...	22°·5	1905	+6°·5	−0°·4	1915	−16°·4	22°·9	16°·0
Sept. ...	26°·8	1908	+5°·7	13°·4	1903	−7°·7	13°·4	21°·1
Oct. ...	27°·6	1905	+3°·0	18°·4	1904	−6°·2	9°·2	24°·6
Nov. ...	31°·1	1904	+3°·3	23°·2	1913	−4°·6	7°·9	27°·8
Dec. ...	32°·4	1913	+1°·8	28°·8	1904	−1°·8	3°·6	30°·6
Year ...	26°·6	1908	+2°·6	20°·6	1915	−3°·4	6°·0	24°·0

In some years the climatic features are in general those that pertain to a continental situation, while in others oceanic conditions prevail, except for a brief period after the winter solstice, when even in open seasons there is a pronounced tendency towards continental conditions, owing to the freezing of the ocean at no great distance to the south. At all times, however, the climatic conditions are essentially polar, since the islands are situated in the direct track of an Antarctic current, which even when no ice is present brings a constant supply of ice-cold water past the South Orkney group. This cold current extends in a north-east or east-north-east direction (see effect on isotherms, Fig. 4), and its indirect influence has been found by Captain Hepworth to extend as far north as lat. 40° S. on the Greenwich meridian. Bouvet Island in lat. 54° 25′ S., long. 3° 24′ E., is virtually a mass of ice down to sea-level, without any vegetation whatsoever, while at South Georgia, in approximately the same latitude but further to the west, there are no less than 214 species of plants, of which nineteen are flowering. Further to the west in Tierra del Fuego the climatic conditions are those normal to extensive land areas in the south

temperate zone, a result largely due to the Föhn-like effect that accompanies the excessive precipitation on the western coasts. The distribution of temperature through the months of the year at various places from 51° to 61° S. is shown in Fig. 5.

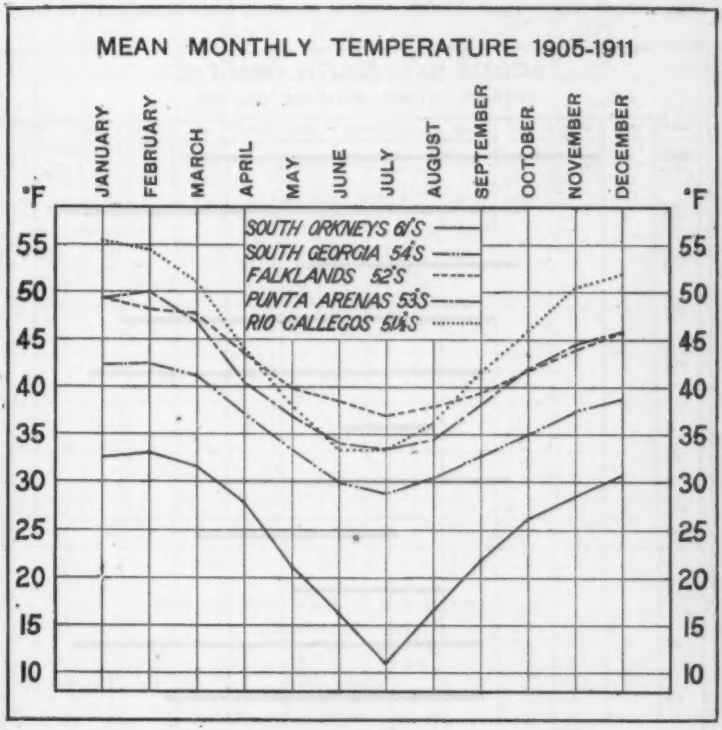


FIG 5.

At Laurie Island, South Orkneys, a careful note has been kept of the period during which Scotia Bay has remained frozen, the results being shown graphically in Fig. 6.

Thus Scotia Bay is closed with compact ice on the average 177 days in the year, the periods varying from 272 days in the season 1904–1905 to only 52 days in 1908. The earliest date of freezing was March 30 in 1903, and the latest July 25 in 1910. In 1908 the bay opened on August 27, while in 1905 it was not until February 6 that the ice broke.

An even later date may be assigned to 1903, as the Scottish Expedition found Scotia Bay still frozen at the beginning of February, when the islands were first visited. The bay was probably clear of ice only for a few days

in March, as when winter quarte[illegible]re found there on March 27 it was quite obvious from the appearan[illegible]f the icefoot that the bay had only very recently been ice free. In most cases pack ice drifts into the bay with a south wind, and then becomes consolidated; but occasionally, as in 1908, the seas are free of pack, a level plain of young ice forming as the temperature falls. Pack is often seen in summer, when from time to time

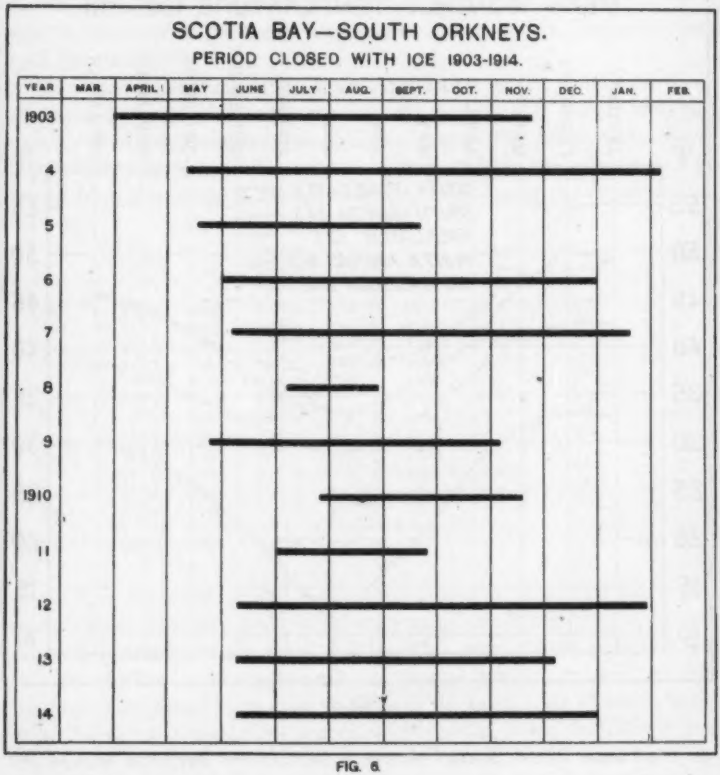


FIG. 6.

the islands are for perhaps several days enveloped in a broad stream of ice. In the very open season of 1908 Captain Larsen met with much pack in the middle of November when in lat. 59° S., long. 26° W., eleven weeks after the ice cleared away from the Orkney group. The effect of these variations in the amount of ice on the air temperature is shown in Fig. 7, which gives the mean monthly temperature of the mildest year 1908, and the coldest year 1915, with the normals for the period 1903–1914.

As it is only ocean swell that causes the disruption of the ice on the south coast of Laurie Island, the break up of the ice is an index that the

1977 316
9 930

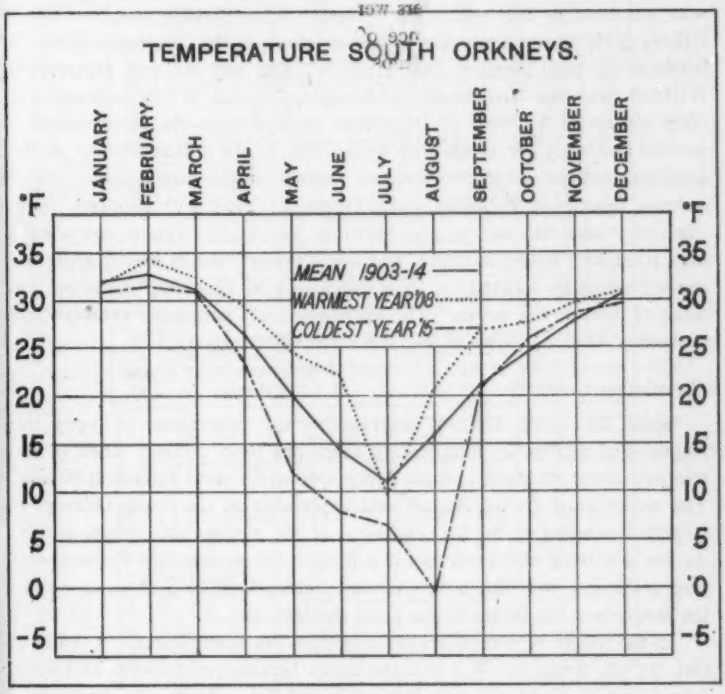


FIG. 7.

ISOBARS AND PREVAILING WINDS FOR DECEMBER, 1904.

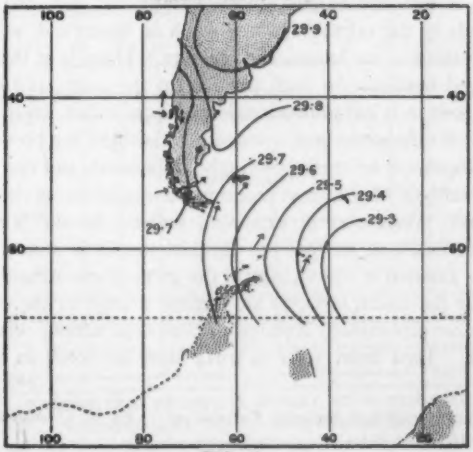


FIG. 8.

seas are clear to the west. The quantity of ice flowing past the South Orkney group must largely depend on variations in the barometric gradient between the high pressure over Graham Land and the low pressure in Weddell Sea. In November, for example, the seas in low latitudes are often clearer of ice than in December, as there is in the latter month a marked tendency for south-west winds, due to the intensification of the gradient between these two "action centres of the atmosphere." Such summer months as February 1903, December 1904, and February 1905, when the pack was met to the north of the South Orkneys, are always associated with strong southerly and south-westerly winds, which bring the ice-belt normally located on these meridians in about 64° S., some 300 miles or more to the north. The distribution of barometric pressure and prevailing winds is shown in Fig. 8 for December, 1904.

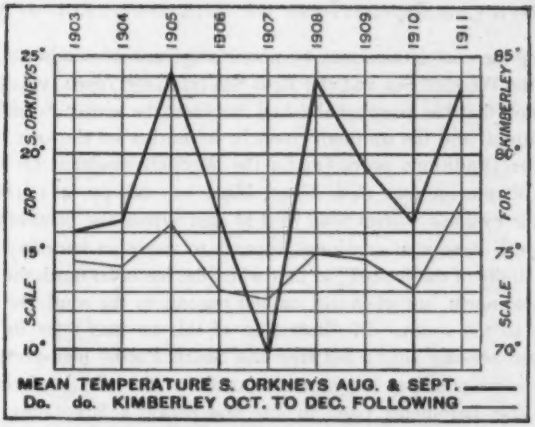
*Correlations.**

Since the South Orkney observatory was established in 1903 the August and September temperature there has been a direct index of the temperature at Kimberley, South Africa, during the three months following. The temperature during August and September at the South Orkneys is largely dependent on the ice conditions of the surrounding ocean, and as the ice is moving east-north-east it is feasible to suppose that the temperature prevailing over the South African plateau is related in some way to the antecedent conditions in the great southern ocean.

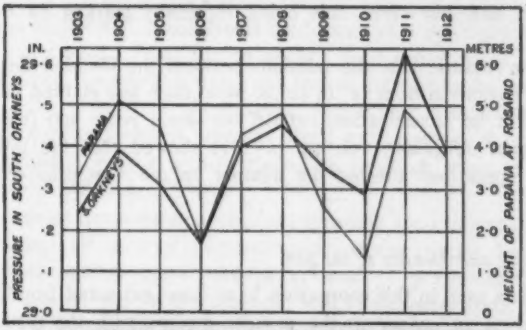
In the month of December the height of the River Parana at Rosario (lat. 33° S., long. 61° W.) and the mean barometric pressure at Laurie Island, South Orkneys, are intimately related. When the barometric pressure in the sub-Antarctic is high the height of the Parana is also high, and when pressure is low in the far south the Parana is also low. The explanation is that the height of the Parana, as measured at Rosario, really depends on the rainfall over the south of Brazil and adjacent areas, and this is related to the barometric pressure. There is at this time of the year a marked tendency for high pressure to the south and south-east of Cape Horn, and it is not unreasonable to suppose that when the Graham Land lobe of the Antarctic anti-cyclone is intensified the pressure over the interior of Brazil will be correspondingly diminished, and *vice versâ*.

In the month of May a most pronounced opposition is shown between the barometric pressure at Stykkisholm, Iceland, lat. 65° N., and Laurie Island, South Orkneys, lat. 61° S. Stykkisholm, it is almost superfluous to remark, is situated in the vicinity of the great North Atlantic "centre of action," while the South Orkneys are located a little to the north-west of one of the most pronounced Antarctic "centres of action," viz. that in the Weddell Sea. Data from 1902 to 1914 show no break in the sequence (Fig. 9).

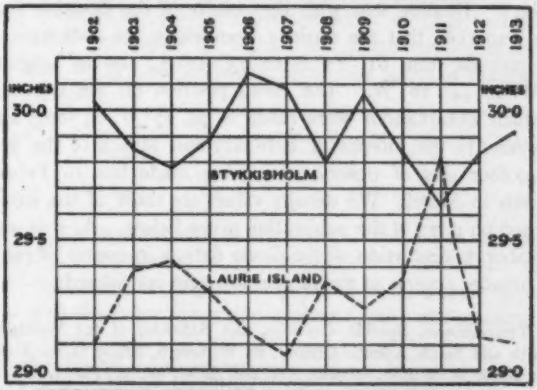
* "Southern Hemisphere Seasonal Correlations." By R. C. Mossman. *Symons' Meteorological Magazine*, 1913.



MEAN TEMPERATURE S. ORKNEYS AUG. & SEPT. ——
Do. do. KIMBERLEY OCT. TO DEC. FOLLOWING ——



BAROMETRIC PRESSURE AT THE SOUTH ORKNEYS
AND HEIGHT OF THE PARANA IN DECEMBER.



BAROMETRIC PRESSURE IN MAY AT STYKKISHOLM,
ICELAND (LAT. 65° N.) AND LAURIE ISLAND,
SOUTH ORKNEYS (LAT. 61° S.)

FIG. 9.

Among the correlations may be noted a see-saw of weather conditions between the Weddell Sea and the Ross Sea (cf. *Geog. Journ.*, vol. 47, p. 67). The relation that has been established between the winter rainfall on the Chilian littoral and the southern rivers in Argentina on the one hand and the weather conditions prevailing in the Weddell quadrant on the other are also of interest (see *Scot. Geog. Mag.*, vol. 26, pp. 411–416). The track of the cyclonic storms from west to east across the southern portion of the South American continent appears to move in harmony with the northern limits of the ice-belt, so that when the ice is far north the cyclonic track is also north, but when the ice-belt retreats to the south the cyclones also pass to the south. In illustration of this we may refer to the very pronounced see-saw shown between the South Pacific high-pressure area and the corresponding low-pressure area in the Bellingshausen Sea, as when the barometer rises in the one region a fall takes place in the other, and *vice versâ*, this being especially marked in the winter months.

On the Atlantic side the relations between the Weddell Sea low and the coast stations in from 35° to 40° S. were much less marked than on the Pacific; but an investigation carried out some years ago (see *Symons' Meteorological Magazine*, vol. 45, p. 181) showed that the influence of Antarctic conditions affected the weather on the Argentine coast up to lat. 35°.

Temperature and Density of the Sea.

The data used in this connection have been extracted from the observations given *in extenso* in the memoir dealing with the results of the Scottish National Antarctic Expedition * and of the German Antarctic Expedition.† Dealing first with the results of the Scottish Expedition it may be remarked that the stations from which the data were obtained range in latitude from 61° 22′ S. to 73° 30′ S., and in longitude from 10° 52′ W. to 44° 26′ W. The mean position on the thirty-one days during which observations were made is lat. 67° 6′ S., long. 29° 22′ W. The data refer to the months of February and March of the years 1903 and 1904, four sets of observations being made late in February and twenty-seven in March. The density values are those of the water *in situ*, as explained on p. 77 of the publication given below. As it is understood that an elaborate discussion of the *Scotia* data is in course of preparation, only the broader aspects of the subject are here considered.

* The Temperatures, Specific Gravities, and Salinities of the Weddell Sea and of the North and South Atlantic Ocean. By William S. Bruce, LL.D., Andrew King, F.I.C., and David W. Wilton. *Trans. Roy. Soc. Edin.*, vol. 51, Part I. (No. 4). Edinburgh, 1915.

† Brennecke, Dr. W., "Ozeanographische Arbeiten der Deutschen Antarktischen Expedition (Die Eisfahrt)." *Annalen der Hydrographie*, 1913, pp. 134–144.

The results are given in the annexed table:—

Depth in fathoms.	*No. of observations.*	*Temperature. Degrees F.*	*Density* in situ.
0	31	29·7	1·02720
53 *	10	29·7	767
100	9	30·1	775
200	6	32·7	787
300	7	32·5	782
400	6	32·2	782
500	9	32·7	774
600	2	31·1	776
700	3	32·5	782
800	1	32·4	780
1000	9	32·0	774
1400	4	31·9	782
1500	7	31·5	791
2000	8	31·6	799
2200	1	32·4	776
2400	4	31·5	777
2500	6	31·4	784

Hence in the first 100 fathoms cold water of a relatively low specific gravity is met with. From 200 to about 1400 fathoms water of Atlantic origin is found, the warmest water and that of lowest specific gravity being encountered at a depth of 500 fathoms. Below 1400 fathoms the temperature with rare exceptions is constant about 31°·5 down to the bottom, the greatest density being at 2000 fathoms, below which water of somewhat lower density is found.

The bottom temperature at depths exceeding 2000 fathoms is remarkably uniform. Of thirteen observations at depths ranging from 2092 to 2680 fathoms eleven varied between 31° and 31°·9, eight of these being either 31°·4 or 31°·5. In two cases (27 and 28 February 1904, lat. 66° 14′, long. 31° 18′ W., and 66° 43′ S., long. 27° 55′ W. respectively) the bottom temperature was 29°·7 and 29°·0. In three cases in which bottom soundings were obtained in relatively shallow water of 1131 to 1400 fathoms the temperature was somewhat higher than in greater depths, being 31°·9. The following are the particulars of these two series of bottom temperatures and densities:—

No. of obsns.	*Mean depth. Fathoms.*	*Mean lat.* ° ′	*Mean long. W.* ° ′	*Temp.* °	*Density.*
3	1250	71 44	17 16	31·9	1·02785
10	2467	69 10	29 17	31·1	1·02777

In the more eastern parts of the Weddell Sea, close to the Antarctic continent, the bottom water is thus largely mixed with water of Atlantic origin, as shown by its higher temperature and specific gravity when compared with the water filling the greater depths of the western portion of this sea.

From the results of the German Antarctic Expedition the following condensed abstract dealing with the bottom temperatures in various parts of the Weddell Sea has been prepared:—

* Mean of ten observations between 30 and 90 fathoms.

Date.	Extreme positions. Lat. S.	Long. W.	Mean position. Lat.	Long.	No. of obsns.	Mean depth.	Bottom temp. °C.	°F.
	° °	°	° ′	° ′		Fath.		
Dec. and Jan. 1911-12	61 -74½	27 -33½	68 45	29 28	8	1802	−0·33	31·5
Jan. and Feb. 1912 ...	75 -77⅜	31½-41	76 46	35 03	7	308	−1·89	28·6
Mar. to Aug. ,, ...	72½-67	36 -45	71 28	43 37	11	2125	−0·62	30·9
December ,, ...	62½-60	36½-38	61 03	37 19	6	1618	−0·32	31·5

The bottom temperatures thus agree very closely with those of the *Scotia* over the areas traversed by both expeditions. In higher latitudes from 75° S. to Prinz Regent Luitpold Land the bottom temperature is very low in the shallow water lying over the continental shelf.

Surface Temperature and Density.

The mean sea surface temperature and density observed during the two cruises of the *Scotia* were as follows, 209 observations being utilized. The air temperature is appended for comparison :—

Month.	Mean lat. S.	Mean long. W.	Mean temp. of sea.	Mean of air.	Mean density.
	° ′	° ′			
Feb. 1903	64 0	29 45	30·0	27·8	1·02673
Mar. 1903	64 1	40 52	29·4	25·0	1·02705
Mar. 1904	70 18	17 47	29·7	25·0	1·02727

Hence in comparatively high latitudes the sea temperature in late summer and early autumn is considerably higher than that of the air.

A point of some little interest refers to the northern limit of water of Antarctic origin. To throw light on this question I have examined the sea temperature observations taken on the voyages of the *Scotia* and of the various relief expeditions to the Argentine station on Laurie Island. These relief observations were carried out on various dates from December to February, but confining the inquiry to those effected in the month of February (when the sea and air temperature are at their annual maximum) we obtain the following positions, in which the sea temperature fell to 2° C. (35·6° F.) or below. The reading on 30 January 1903 is also given. The temperatures and positions are those at noon on the dates specified.

Date.	Lat. S.	Long. W.	Sea temperature. °C.	°F.
	° ′	° ′		
1903 Jan. 30	57 2	47 15	1·7	35·1
1904 Feb. 12	58 53	50 40	1·7	35·1
1908 Feb. 16	59 0	49 16	1·8	35·2
1909 Feb. 6	60 7	45 10	2·0	35·6
1911 Feb. 9	58 41	48 43	1·8	35·2
1913 Feb. 10	58 37	47 44	1·9	35·4

Thus the region in which polar water is encountered has varied through three degrees of latitude in a mean position longitude 48° W. In the relief expedition of 1906 the sea surface temperature did not fall to 2° C. until a position 59° 11′ S., 46° 6′ W. was reached, and that as early as December 22. Reference to the diagram showing the period during which Scotia Bay was closed with ice indicates the close relation that obtains between the two classes of phenomena.

Surface Temperature of the Sea at the South Orkneys.

The mean monthly temperature of the sea and the corresponding air temperatures are shown in the annexed table. The data refer to the seven years 1904 to 1910.

	Sea temperature. °	*Air temperature.* °	*Difference of air from sea.* °
January	32·0	32·5	+0·5
February	32·2	33·1	+0·9
March	32·1	31·6	−0·5
April	30·7	27·5	−3·2
May	29·3	19·6	−9·7
June	28·8	15·3	−13·5
July	28·8	9·7	−19·1
August	28·6	15·2	−13·4
September	28·9	19·2	−9·7
October	29·4	25·1	−4·3
November	30·0	29·4	−0·6
December	31·5	30·6	−0·9
Mean	30·2	24·1	−6·1

The mean annual temperature of the sea surface is 30°·2, and shows a range between the months of 3°·6 Fahr. The sea temperature is highest 32°·2 in February and lowest 28°·6 in August. In January and February the surface temperature of the sea is slightly lower than that of the air. In all other months it is higher than that of the air, the excess being small in March and December and large in the winter months.

Depth of the Weddell Sea.

The general depth of the Weddell Sea except near the land is between 4500 and 5000 metres or 2500 fathoms. Shallow water is shown between the South Sandwich group and the South Orkneys, while close to Coats Land soundings of 161 and 159 fathoms were obtained 2 miles from the shore. Relatively shallow water was also found to the east, indicating an extension of the Antarctic continent in that direction, and shallow water was also found by the German expedition to the south of 75° S. (see general map).

Deep-sea Deposits.

In the Weddell Sea south of 60° S. the bottom deposit is either blue mud approximating to red clay, or blue mud and terrigenous deposits.

Further north we enter the area of diatom ooze which markedly contracts west of the 25th meridian. Within the area of blue mud most of the material carried off Antarctic lands is deposited through the gradual dissolution of the icebergs. The area of blue mud approximating to red clay extends furthest north not far from Bouvet Island, a little to the west of the meridian of Greenwich, on which longitude the greatest northern extension of the polar water occurs.

As showing the lowering effect on the sea temperature of this ice-drift,

it may be noted that the isotherm of 2° C. (35°·6 Fahr.) on the Greenwich meridian in summer lies in about 51° S., whereas in the vicinity of the South Shetland the same sea temperature is not reached until 62° S. on the meridian 60° W.

Magnetic Observations.

Absolute determinations of the magnetic elements were commenced by the writer in May 1903, and continued by him in this form until the end of 1904. A discussion of the 1903 data by Dr. Chree, F.R.S., appears in Vol. 2 of the *Scotia* results, while the results for the year following when the station was carried on under Argentine auspices are discussed by Mr. L. G. Schultz in Vol. 16 of the *Anales of the Oficina Meteorológica Argentina*. In January 1905 automatic methods of registration were introduced, and the data down to the end of 1912 are quoted in Part II., Vol. 17 of the above *Anales*, pp. 173–314. The following comparison from hourly records for the years 1905 to 1912 will be sufficient to indicate the annual march of the magnetic elements.

Year.	*Declination.*	*Horizontal force.*	*Dip.*	*Horizontal intensity.*	*Total force.*
	° ′		° ′		
1905	5 16·0 E.	0·25667	54 31·0	0·25558	0·02358
1912	4 44·6 E.	0·25334	54 26·0	0·25256	0·02110

Tides.

The tidal observations made at Laurie Island, while the *Scotia* was frozen in from March to November 1903, are discussed by the late Sir George H. Darwin, who remarks that the tide seems to be normal for a place in the Southern Ocean. "The semi-diurnal tides are considerable, but the solar tide is unusually large compared with the lunar tide, the ratio being 0·6 as compared with 0·465 of the equilibrium theory. The semi-diurnal tides are almost exactly 'inverted,' so that low water occurs very nearly when the moon is on the meridian" ('*Scotia* Reports,' vol. 2, 'Physics,' pp. 321–324).

Before the paper the PRESIDENT said: Mr. Mossman, who is to give us a paper on the Weddell Sea, has been in that inhospitable region with Dr. Bruce. He has lived for some time in the South Orkneys, and he has made a particular study of the meteorological conditions of that portion of the globe.

(*Mr. Mossman then read the paper printed above and a discussion followed.*)

Dr. H. R. MILL: It is a very great pleasure for me to be here. Mr. Mossman is one of my oldest friends and colleagues, and he is the only man at present in this country who has had experience of meteorological observations in those regions. It was he who as a member of the staff of the *Scotia* founded the meteorological station in the South Orkneys, and he remained there during the time when the *Scotia* was making her second trip in the Weddell Sea, so that he spoke from experience, which his modesty hardly let you perceive, when he referred to the extremely unpleasant conditions of the winter there. I am

tempted to follow him into the historical portion of his narrative, but I think it would be better to leave that until the return of Sir Ernest Shackleton, who will doubtless have a good deal to say about the *coup de grace* which he has given to New South Greenland, an old enemy of mine, the non-existence of which I argued from historical evidence in the 'Siege of the South Pole.' The special importance of this paper has been taken out of it by the happy perversity with which Sir Ernest Shackleton emerged just at that moment when we were planning how we could best try to find him. If no news had been received from the Weddell Sea this paper would have been very useful, because it embodies those conditions of the atmosphere and the sea-ice from which alone it would have been possible to formulate any plan for proceeding in search of the *Endurance* or her crew. Fortunately this application of the paper is no longer required, but it bears on the prospects of the little trawler that has gone out by the good offices of the Uruguayan Government to bring off the party from Elephant Island, and it is very satisfactory to know from Mr. Mossman that the chances of that vessel making a successful rescue are so good. We shall look forward in the course of a week or so to hearing of the fulfilment of his expectation. I do not say his prediction, because he is too good a meteorologist to venture on predictions of a definite kind. With regard to the atmospheric movements in these regions, it has been pointed out by every voyager who went down into the far south that the prevailing winds were in the main easterly, in direct contrast to the westerly winds of the Roaring Forties, and it is a very curious thing that almost every explorer who has ever tried to navigate those seas has tried to do so in the teeth of the prevailing wind. The drifts of the *Deutschland* showed most definitely that in the far south the wind and currents drove it from east to west, in the middle latitudes from south to north, and in the neighbourhood of the Antarctic circle the tendency was again from west to east. This fact would have enabled us, from the data already known, to have formed some idea of the probable drift of the *Endurance* on the hypothesis that she was caught in the ice. The fact fits in most neatly, for, as we saw from the chart which Mr. Mossman displayed, the drift, so far as we can judge it from three points (and three points give a very fair idea), was almost exactly parallel with that of the *Deutschland*, and show the same conditions prevailing presumably right across the Weddell Sea up to the land. I am quite sure we shall all unite in thanking Mr. Mossman for giving this invaluable combination of personal experience and scientific study, and bringing it to bear on what was when he started this paper a practical problem of the most pressing importance.

Dr. RUDMOSE BROWN : There is very little to add to what Mr. Mossman has said, but I had the privilege of visiting part of the Weddell Sea he has not been in, so perhaps I may say what happened to the *Scotia* when she was caught off Coats Land. I was on board her both times she penetrated the Weddell Sea. In 1903 she was caught in about 70° S., and in 1904 in 74° S. On both occasions we drifted towards the west, on the second occasion rapidly. The fate that overtook the *Deutschland*, and in a more serious way Sir Ernest Shackleton's *Endurance*, is a fate which the *Scotia* narrowly escaped, particularly in the second year. We expected she would be crushed, and she only escaped because she was such a good ship. I think Sir Ernest Shackleton would be the last to deny that she was a stronger ship than the *Endurance*. We expected to drift towards the west and then north. We had not at that time the knowledge of any ship drifting in that way, but we did believe in New South Greenland, and some believe in it yet, and there is much evidence in

favour of it despite Sir Ernest Shackleton's discoveries. It is not an easy thing to take a longitude when you get to this latitude, and it is quite possible that Morrell's longitudes were wrong. He wrote his book ten years after his voyage, which must explain a good many discrepancies in his account. There is one other thing I might add with regard to the conditions on Elephant Island. I have lived for about eight months on Laurie Island, one of the South Orkneys, which are about 200 miles east of Elephant Island. I dare say many people think Shackleton's men are living in the ice-cave he described as having left them in, but I think that this is most improbable. Elephant island is from 30 to 40 miles long. It is rather a mountainous island, probably of just the same nature or origin as Laurie Island. Though you might, on landing at the head of some bay, find yourself forced to live in an ice-cave for a few days, you would be very silly to stay there longer. There is scarcely a bay in Laurie Island where you cannot get up on the ice covering the land and move to better quarters, and I am quite sure that the party under the leadership of such an expert as Mr. Wild will have moved to much better quarters. We found seals in Laurie Island all through the winter, and Shackleton's men should find both seals and penguins on Elephant Island. I think it not impossible they may find whalers' huts there also, left by Argentine and Chilean whalers who may have visited the island. And there is a bare possibility of finding a lowly form of coal, which if mixed with blubber makes an uncommonly good fire. I dare say you noticed from the charts the possibility of open water up to Elephant Island just as there has been open water up to Laurie Island even in mid-winter. It is perhaps more likely on Elephant Island than on Laurie Island. That of course gives hope that the Uruguayan vessel will be able to reach them, for she appears to be an unprotected vessel, and could not penetrate heavy pack without grave risk.

The PRESIDENT: It remains for me to thank Mr. Mossman for the trouble he has taken in preparing this lecture and the slides and diagrams that have illustrated it. These have given us a good deal of information which will help us to understand better Sir Ernest Shackleton's story when he comes back to this country. I will conclude by expressing the fervent hope of the Council that we may have the happiness of seeing Sir Ernest Shackleton with the whole of the members of his Weddell Sea party in this country before long. It is a great satisfaction to us all that the Admiralty have been so speedily authorized by His Majesty's Government to use the best means available for the relief of the men left on Elephant Island, and have acted with such exemplary promptitude.

THE SAKURA-JIMA ERUPTION OF 1914.

The Sakura-jima Eruptions and Earthquakes. **Prof. F. Omori.** *Bull.* Imp. Earthq. Inv. Com., vol. 8, pp. 1–34 (1914), and pp. 35–179 (1916).

ON 12 January 1914 a great eruption, accompanied by numerous earthquakes, occurred in the volcanic island of Sakura-jima in Southern Japan. The various phenomena have been investigated with great care and thoroughness by Prof. F. Omori, the director of the Seismological Institute at Tokyo. The results of his researches are contained in two valuable memoirs, of which an abstract is here given.

The volcano of Sakura-jima, formerly an island but now a peninsula, lies immediately to the east of Kagoshima and near the north end of Kagoshima Bay, an inlet more than 40 miles in length. Before the eruption it was separated from the west coast by a channel 1½ to 2½ miles wide and 38 to 77 fathoms deep, and from the east coast by the Straits of Seto less than half a mile wide and 45 fathoms in maximum depth. The latter is now blocked up by a new stream of lava. To the north of Sakura-jima, the Bay of Kagoshima forms a basin the depth of which lies between 70 and 107 fathoms. Sakura-jimo is 6 miles long from east to west and 5 miles wide from north to south, and rises in the central peaks to heights of 3509 and 3719 feet. The volume of the island above sea-level is estimated at about 6⅓ cubic miles.

From 1468, the year of the first recorded eruption, until 1914 there have been twenty-six eruptions of Sakura-jima. Prof. Omori groups them in three principal epochs: (i) 1468–1476, during which there were five outbursts, three being large, and followed by a minor epoch (1642–1766) in which there were eight small eruptions; (ii) 1779–1799, including eleven eruptions, of which that of 1779 was violent; (iii) 1914, a second great eruption, there having been only one slight action in 1860. In these three epochs outflows of lava took place from craterlets arranged on almost opposite flanks of the mountain, in the first on the east-north-east and south-west flanks, in the second on the north-north-east and south, and in the third on the east-south-east and west-north-west flanks. In the two later epochs the outflows on opposite sides began almost simultaneously.

The last eruption of Sakura-jima occurred during a recrudescence of volcanic activity in Japan. After the great explosion of Bandaisan in 1888 there followed fifteen years (1889–1903) of comparative quiescence. From 1904, however, outbursts increased both in number and violence, culminating in the epoch of six years, 1909–1914, during which there were 194 eruptions from eleven different volcanoes. In the year 1914 seven volcanoes were in action.

The eruption was preceded by the usual signs. At 3.41 a.m. on January 11 an earthquake, strong enough to waken sleepers, was felt at Kagoshima. This was followed by numerous slight shocks, which rapidly increased in frequency, as many as 418 being registered by the seismograph at Kagoshima observatory from 3 a.m. on the 11th until 10 a.m. on the 12th. Early on the morning of the 12th hot springs broke out at several places on the south coast of Sakura-jima, and at 8 a.m. on the same day columns of white smoke were seen to rise from the mountain. Knowing well the early symptoms, the authorities secured the safe removal, with three exceptions, of all the inhabitants of the island, more than 23,000 in number.

The actual eruption began at about 10 a.m. on January 12 with an outburst on the west side of the island. Ten minutes later another occurred on the east side, after which the outbursts increased in frequency and

strength. At 10.30 a.m. ashes and lava fragments were projected. The eruptive noises became more intense, until at 3.30 p.m. the loud detonations began. At 6.30 p.m. a severe earthquake occurred. The explosive stage reached its full intensity between 11 p.m. on the 12th and 5 or 6 a.m. on the 18th, the maximum being at about 1 a.m. After 10 a.m. on the 13th the explosions, though frequent, were greatly reduced in strength. The first outflow of lava took place on the evening of the 13th. On January 25 the eruptions on the west side practically ceased; those on the east side continued for some months longer and were occasionally strong even as late as August.

Two main streams of lava flowed down towards the west and south-east. The former, which had a maximum thickness of about 200 feet, was about 3 miles in length and advanced nearly a mile into the western channel. The south-eastern stream was much the larger. It covered a hill 406 feet high on the coast, blocked up the Seto Straits, and advanced nearly $2\frac{1}{2}$ miles into the sea, the last 2 miles of its course being under water. The areas covered by the two streams are respectively $3\frac{1}{4}$ and 6 square miles, and their volume 0·08 and 0·29 cubic miles.

As is usually the case in Japanese eruptions the ashes were drifted in an easterly direction from the mountain owing to the prevalence of the upper westerly winds. The greatest depth attained by the layer of ashes was about 13 feet, on the eastern side of the volcano. The area of ash-precipitation extends to a distance of 765 miles towards the north-east and 9 miles towards the south-west. The volume of ashes and pumice is estimated at 0·15 of a cubic mile. Added to that of the lava, the total material ejected amounts to about half a cubic mile or one-twelfth of the volume of the mountain.

The earthquake which occurred at 6.30 p.m. on January 12 is of unusual interest. It differs in every respect from the local shocks and tremors which accompany volcanic eruptions. Though walls were overthrown by it at Kagoshima and nineteen persons were killed, the intensity of the shock was in no place severe. (It may be mentioned that the vibrations were recorded in European observatories.) It is evident that the seismic focus was at a considerable depth, and that the earthquake was due to stresses along the whole volcanic chain in Southern Kyushu and not to the volcanic operations taking place in Sakura-jima.

About an hour or an hour and a half later a small seismic sea-wave or *tsunami* swept over the low portion of Kagoshima. It was not, however, connected with the earthquake, but was probably due to a sudden small settlement or depression in the bed of Kagoshima Bay.

The high spring tides which followed the eruption revealed the fact that considerable changes of elevation had taken place. The land at Kagoshima and along the north of the bay had apparently sunk from 3 to $3\frac{1}{2}$ feet, and along the northern coast of Sakura-jima by more than $6\frac{1}{2}$ feet; though after the lapse of a year there was a perceptible decrease in these

amounts. More precise estimates of the changes were obtained by a revision of the levellings carried out in recent years by a Military Survey and along the neighbouring railway-lines. These enabled Prof. Omori to draw a series of curves of equal depression. The most important curves, of 500 and 300 millimetres (19·7 and 11·8 inches) cling to the northern boundary of Kagoshima Bay, and their axes intersect in a point to the north of Sakura-jima. Prof. Omori regards this point as that of greatest depression and as probably coinciding with the centre of the principal lava reservoir, which thus lies in the region between the active volcanoes of Sakura-jima and Kirishima. The volume of the depression within the 100 millimetre curve is one-third of a cubic mile, or rather more than one-half the total volume of lava and ashes.

In Sakura-jima itself a revision of the triangulation survey shows that the relative depression of the land continues round the entire coast of the island, but that three points on the higher ground of the interior (at heights of 147, 2178, and 1339 feet) were relatively raised by $5\frac{1}{2}$ inches, 30 feet, and 41 feet. Deductions must be made from the latter figures on account of the thick deposit of ashes, but it is clear that the central portion of the island has been elevated, and all the surrounding country depressed, with regard to the level of the sea.

The same revision has manifested considerable horizontal displacements of the area. Points on the south-west coast have been moved from 6 feet 8 inches to 11 feet 11 inches towards the south; others on the north-west and north coasts from 3 feet 6 inches to 14 feet 10 inches towards the north and north-east. The northern and southern halves of the island have thus been thrust outwards in opposite directions. Points on the west side of Kagoshima Bay have been shifted by 2 to 3 feet in directions which, with those in the north of Sakura-jima, converge within an area coinciding roughly with the region of greatest depression.

CHARLES DAVISON.

REVIEWS.

ASIA.

Through Russian Central Asia.— Stephen Graham. London: Cassell & Co. Pp. xii., 280. *Map and Illustrations.* 16*s.* net.

IN this book the author gives an account of his journey from Baku on the Caspian to Semipalatinsk on the Irtish within the borders of Siberia. As far as Kabul Sai he availed himself of the railway, visiting Askabad, Bokhara, Samarkand, and Tashkend on the way. Of these towns he gives interesting glimpses, especially of the wonderful city of Bokhara with its walls and carpets. Beyond Kabul Sai he took the road, and the story of his tramp through Pishpek, Vernoe, Ilisk, Kopak, and Sergiopol forms the most interesting part of his narrative. From Semipalatinsk he took a steamer trip up the Irtish to Malo-Krasnoyarsk near the Altai mountains, the river winding through gorges and cliff scenery of a most impressive character. He thinks the navigation of

this river may afford one of the sights of the future. "Parties will be taken out. But there is no romance, no castles, no ruins—only Nature and the grey tumultuous misery and beauty of a scarred continent."

In this way the regions known as Trans-Caspia, Sirdaria, and the Seven Rivers Land were traversed. It was through the last that his walking tour took place, and this is what will probably most interest the reader. Here he was brought in contact with the Kirghiz, both settled and nomad, of whom he gives some striking little sketches, their tent life, the children, the flocks, and their skill in falconry, foxes being captured by trained eagles. Here also were encountered the numerous colonists going east to settle on new lands. A graphic picture is given of these peasant pioneers on their new quest, and of the lands to be cultivated. Quite as interesting is an outline of the method of this Russian colonization pursued under the guidance and with the help of the Imperial Government. The custom of sending out *khodokoi* or prospectors to spy out the land in advance, and report to the peasants they represent on the suitability or otherwise of the country they have inspected for settlement, with the information, advice, and help offered to intending colonists, show the paternal character of the Russian Government in a very interesting and favourable light. Mr. Graham's comparison of this Russian colonization with our own in our oversea dominions, and his reflections thereon, are well worthy of attention and consideration. He describes the colonial village as an artificial oasis made by Russian colonists and irrigation engineers. It is "not a haphazard growth such as the ordinary European village. It does not simply grow: it is planned by the Government engineers and indicated on a schedule before a single inhabitant has set eyes on it." He is impressed with the wandering spirit innate in this peasant folk, and sees in it the foundation of the Russian empire. "Asia becomes predominantly Russian," he remarks, "not by virtue of the troops stationed at outlandish posts, but by virtue of this process of settling." In fact, though Russia gained Central Asia by conquest, and very easily—almost by military processions—she has held the country only through these peasant pioneers who followed the armies, and began to settle on the land, and the peasants would not have remained if they had not been helped by the Government.

The author explains in his introduction that portions of the book have already appeared in the columns of *The Times* and *Country Life*, and this no doubt accounts for the rather sketchy character of some of its contents. But his keen observation and wide sympathies make his whole story full of interest and instruction, and as a side light on the country and peoples of our great Eastern ally it appears at a very opportune moment. There are numerous good full-page photographs and a map of Russian Central Asia showing the author's route. If the last had been on a larger scale it would have been an advantage as helping us to follow the author more closely on his travels.

E. A. P.

Travels in the Middle East, Being Impressions on the Way in Turkish Arabia, Syria and Persia.— Captain T. C. Fowle, 40th Pathans. London: Smith, Elder & Co. 1916. Pp. xii. and 277. *7s. 6d. net.*

Captain Fowle made these journeys in the course of two "language-leaves" from India not long before the war, and he had already written his book when the war broke out. On the first journey he takes us from Karachi up the Persian Gulf to Basra, and thence up the Tigris to Baghdad. Here Captain Fowle stayed for some weeks. He then made an excursion into the borders of

Kurdistan and as far as Suleimaniyeh. Not long after his return from Suleimaniyeh to Baghdad he set out again, this time for Damascus. He went first to Kerbela, and thence northwards to Ramadi on the Euphrates below Hit. From Ramadi he rode for some marches along the river-valley, following the great Baghdad-Aleppo route, but tired of the highway he left his caravan at Abu Kamal, and with an Arab guide for his only companion struck across the desert to Tadmor. There he rejoined the caravan, which had come from the Euphrates by the ordinary desert-route from Deir. After a fight with robbers between Tadmor and Kariatein, Captain Fowle arrived safely at Damascus, and this part of the book ends with some memories of "A Sojourn in Sham."

The scene of the second part is Persia. From Nushki, the railhead beyond Quetta, Captain Fowle journeyed over the great desert to Nasratabad, crossed the Hamun Lake, and rode on to Meshed by Birjand. At Gunabad, "seven marches south of Meshed," he saw, fortunately for himself and his readers, the Persian Passion Play of the Death of Hussain. He went from Meshed to Askabad in Russian territory, from Askabad by railway to the Caspian, across the Caspian to Baku and Enzeli, from Enzeli southwards to Teheran and Isfahan, and from Isfahan by the Lynch road through the Bakhtiari Mountains to the plains of Arabistan. At Ahwaz the tale ends.

In his preface Captain Fowle says that he has tried to answer the question, "What is it like?" and by "it" he means simply travel in the Middle East. He is not here concerned with politics, nor with any scientific study, nor with the exact recording of the stages and hours of the march. He merely sets down for the entertainment of his readers how he fared on the road and in cities. Within the limits which he has marked out for himself he has written a pleasant and profitable book.

Captain Fowle has not been moved to describe famous places by the thought that a description might be expected from him. To use his own word, he "skips." Basra and Kerbela he skips altogether; Babylon he only mentions long after we have passed it, and then as something that did not interest him, because he was hungry, cold, and tired, and the sunset over the desert seemed more worth looking at than the ruin-mounds. In Persia he skips Meshed and Teheran. Having written his book before the war, he has not altered or enlarged it to satisfy our present curiosity. The chapter headed "Busra–Baghdad" tells us of his fellow-passengers on the river-steamer, but for the rest shows us only "swirling water," "great bare plains," and here and there on the banks armed men and Bedouin tents.

Though the style is in places rather slovenly, the author can convey to us something of his own keen pleasure in the sights and encounters of the road. He can make us see clearly his landscapes and his city crowds, the caravan on the march, the camp, the groups in caravanserais or in the tents of the nomads. Some of the persons whom we meet are set vividly before us; for instance, the *sheikh* Abdul Aziz, who coveted Captain Fowle's revolver, and cast his Arab mind this way and that to get it, and failed in the end. The description of the Passion Play is on the whole very good, in spite of a few lapses of style. Captain Fowle has enjoyed his travels, and has made his reader enjoy them.

It is puzzling to find the Baghdad *guffa*, or *quffa*, called, in the three places where it is referred to (twice in the text, and again in the index), *guga*.

The book is illustrated with 24 photographs. The map showing the author's route might well have contained a few more details.

C. G. S.

AMERICA.

Canada's Future: What she offers after the War. A Symposium of Official Opinion.— Edited by **E. A. Victor.** Toronto: The Macmillan Company of Canada. 1916. Pp. xv., 320. *Frontispiece.*

We regret to learn from a Press telegram that the editor of this book was killed at a railway crossing near Toronto in the early part of September. The purpose and character of the book are sufficiently indicated by the title. The range of contributors is wide. Fifty of the leading public men of Canada have their say about the future of the Dominion in varying phases of its development, some concerned with the country as a whole, some with the individual provinces. The general tone is one of cheerful confidence, though the editorial introduction is careful to insist that "this work is not given to the world as 'a book of praise,' but rather as a collection of thoughtful and judicial pronouncements by representative men whose life-work has helped to make Canada what she is." Sir George Foster, the Dominion Minister of Trade and Commerce, sums the matter up on the first page: "Canada has over-borrowed, over-built, and over-speculated, but is thoroughly sound in mind and limb, and has learned much from past experience." To geographers two of the most interesting contributions are an account of the work of the Commission of Conservation by Mr. James White, formerly Chief Geographer in the Department of the Interior, now Assistant to the Chairman and Deputy Head of the Commission; and a survey of the climate of Canada by Mr. R. F. Stupart, Director of the Dominion Meteorological Service. Referring to some of the less well-known areas, Mr. Stupart says: "It is probable that the northern third part of Manitoba, and also north-eastern Saskatchewan, will never prove of much value for agriculture, as the climate is very similar to that of Patricia. This opinion is, however, only tentative, pending the establishment of interior climatological stations, which may show that general inland conditions differ widely from those at the coast, as represented by Nelson and Churchill. The summer isotherms in Alberta run nearly north and south, hence the extreme northern part of the province from June to the end of August is, climatically, quite comparable with the south." In another contribution of direct geographical interest Mr. Arthur O. Wheeler, President of the Alpine Club of Canada, summarizes the history of climbing in the Canadian Rockies and indicates their outstanding characteristics.

Canada: The Country of the Twentieth Century.— Watson Griffin. Ottawa: Department of Trade and Commerce. 1915. Pp. 283. *Maps and Illustrations.*

Though dated 1915, Mr. Griffin's useful collection of statistical and other information about Canada has only become available in this country during the past few weeks. It is published by authority of Sir George Foster, the Dominion Minister of Trade and Commerce, and has been prepared for the purpose of giving business men who have never visited the Dominion an epitomized but comprehensive review of its forest, agricultural, and mineral resources, its industrial and commercial development, and its geographical relations to the markets of the world. A preliminary chapter on the country as a whole is followed by more detailed accounts of the provinces, which are considered in order from east to west. In the closing chapters the author deals with the fisheries of Canada, its water powers, manufactures, forest products, and farm products. For purposes of reference the value of the work is greatly enhanced by an extensive index (sixteen pages). The maps, ten in number, are all topographical.

Central American and West Indian Archæology.— T. A. Joyce. London: Lee Warner. 1916. Pp. xvi., 270. *Plates, Illustrations and Maps.* 12*s.* 6*d.* net.

In this volume Mr. Joyce completes his survey of the indigenous civilizations which so astonished the Spaniards on their first exploration of America. The two former volumes were devoted to South America and Mexico, and in this the connecting region, comprising the countries now known as Nicaragua, Costa Rica and Panama, together with the Antilles, is dealt with. The author pursues the same method as in the preceding volumes, directing attention largely to the life, customs, and religion of the native tribes as they were at the time of the conquest. The reader may have some difficulty in seeing an appropriate application of the term "Archæology" to an account so largely based on the literary works of those who first reached the New World and their successors, such as Columbus, Oviedo, Peter Martyr, and Las Casas, authors who inspired the glowing pages of Prescott. Mr. Joyce himself evidently feels this to some extent. The strictly archæological evidence is derived from objects of gold and stone, from pottery and some burials. Up to the present these have been found in rather restricted areas, and further research is greatly needed, as the author admits, if archæology is to throw much light on the life of the tribes and their relationships north and south. The most interesting and important archæological discoveries are undoubtedly of pottery, particularly that from the Guetar cemeteries and from Chiriqui. The different forms and artistic decoration of this pottery present a fascinating study, and suggest migration, or at least influence, from the south. The archæological discoveries in the West Indian Islands are of much the same character, but much poorer. So far as they go they are curious, for whilst showing influence from South America, they give little or no evidence of any such from either Florida or Central America. This is, however, in harmony with the more recent migrations into these islands. Mr. Joyce declines to enter upon the much-debated question whether these New World civilizations owe anything to Egypt or Asia. He has evidently not been impressed by Prof. Eliot Smith's somewhat dogmatic arguments.

In collecting all this information within a small compass Mr. Joyce has performed a very useful service, for which anthropologists will be grateful to him. The work is well illustrated with numerous plates, many line drawings in the text, and several maps. A criticism suggests itself regarding the last. It is a pity that in the large folding map at the end the region of most importance, viz. Central America, is represented on such a small scale. It occupies less than a twentieth part of the map, with the result that physical features are not well brought out, and the names are crowded and sometimes difficult to find. In the linguistic map, at p. 30, the different tribes are represented by numbers, and it is necessary to consult a list in the text to find out their situation. This naturally irritates the reader every time he has to refer to this map, which, although containing very few names, represents Central America on a much larger scale than the other. E. A. P.

GENERAL.

An Economic Geography of the British Empire.— Charles B. Thurston, B.Sc., F.R.G.S. London: University of London Press. Pp. xvi., 372.

One good feature of this work will strike the reader at the very beginning, the attention uniformly called to geographical influence. This is done with knowledge and judgment, with the result that we have here an instructive book

of real educational value. It is divided into six parts exclusive of a statistical appendix of eight pages and an index, this, however, printed in a type so small as to be trying to the eyes even in daylight. The first part is on the empire as a whole, and contains chapters on the physical features of the empire and their economic importance; climates of the empire, with a division of the empire into natural regions based upon climate; the material resources of the empire, with a consideration of the question whether the empire can be made self-sustaining; the peoples of the empire; and the links of empire. The other five parts are on the members of the empire grouped according to continents. Instructive as the work is, it requires a good deal of amendment in little things. The differences in the range of temperature are not very happily introduced under latitude (p. 16), and it is rather surprising that Mr. Thurston does this, seeing that he so often emphasizes elsewhere the difference in this respect between east and west coasts. In the statement (p. 56) that "in a country in the latitude of the British Isles, land rising to a greater height than 1000 feet above sea-level is economically of little or no value, unless the rocks contain valuable minerals or the rushing mountain torrents can be utilized for providing water-power," he has evidently forgotten the Canadian North-West. And his account of this latter region is not very satisfactory. He seems to speak (p. 279) as if agriculture were rendered possible in Alberta only by irrigation. It is obviously misleading to include Egypt (p. 25) among Tropical Lands with a distinctly wet season, when we have on the same page mention of another type described as "The west coast or Mediterranean type" of subtropical lands. The people of the West Indies will be sure to protest against the statement (p. 287) that "from August till the end of October fierce hurricanes sweep the islands [British West Indies], doing much damage to ships, houses, and crops." It would convey a wrong impression to lengthen this list, but the author will no doubt make a careful revision for the next edition. One omission we may note, which may have been deliberate on the author's part, but to us nevertheless seems rather surprising. He says nothing at all on the head of tariffs, nothing accordingly as to the tariff concessions freely granted by the self-governing parts of the empire to the mother country. One would have expected some reference to this under "The Links of Empire." G. G. C.

The New Science. Rev. Frank R. Burrows, M.A., F.R.G.S. London: Philip. [1916.] 32 pp. 6*d.* net.

The new science dealt with in this pamphlet, apparently from its style originally a lecture, is that of Geography, on which Mr. Burrows speaks with his customary energy and enthusiasm. Starting from the war he illustrates the important influence of geography in various relations, and to any doubter he exclaims emphatically: "Show me a campaign in History which finished without a river coming into it somewhere, except in Africa, and I will emigrate to Germany."

THE MONTHLY RECORD.

THE SOCIETY.

Hakluyt Tercentenary: the Ceremony in Westminster Abbey.

WITH the kind co-operation of the Headmaster of Westminster School, to whom the Society is much indebted, the ceremony of hanging a wreath in memory of Richard Hakluyt was made part of the school service in the

Abbey on November 23. In the course of a brief address to the school Dr. Gow told how the interest of the young Queen's scholar was aroused when he had leave out of College one day to visit his cousin in the Temple, and saw in his rooms the maps and works on cosmography to which he refers in the Dedication reproduced as a frontispiece to the present *Journal*. The Headmaster added that although the place of Hakluyt's burial is not known with certainty, yet it is known that the bodies of canons of that period were laid in the south transept, where the school service is held, and that the column which the Dean had chosen as the place for the wreath to hang must be very close to the spot where Hakluyt lies. After the address the President, accompanied by several members of the Council and attended by the Secretary, hung the large wreath of bay in its place on the column, and thanked the Headmaster for the opportunity which he had given for the Society to join with the school in commemoration of a famous geographer and Old Westminster.

EUROPE.

Plant Distribution in Scandinavia and Climatic Change.

The present and past distribution of plants and animals as an indication of climatic change in Scandinavia has been a good deal studied of late years, notably by Dr. Gunnar Andersson, who has used the case of the hazel as a special means of estimating the extent of such change since the "Litorina" period (*Journal*, vol. **24**, p. 94). At the time of the most northerly spread of the hazel, as indicated by its fossil remains, the mean temperature must, he concludes, have been some 2·4° C. (4·3° Fahr.) higher than at present during the vegetative period of that tree. A reconsideration of this result, based on a somewhat different method of approaching the question, is attempted by Mr. G. Samuelsson in the *Bulletin* of the Geological Institution of the University of Upsala (vol. **13**, 1915, No. 5). This writer points out that an extension of the period of vegetation may to some extent make up for a lower mean temperature during the warmest month, and he seeks to ascertain whether this is the case with the hazel. (He also adopts a somewhat different limit of normal occurrence of the hazel from that laid down by Dr. Andersson.) From the meteorological data available for a number of stations on or near the present limit he deduces, by a graphic method, the relation existing at these between the temperature of the warmest month and the number of days on which the mean temperature stands above the freezing-point. This, he finds, may be indicated by a curve which brings out a regular increase in the length of the vegetative period (assumed to be that in which the mean temperature remains above freezing) with a decrease of the summer maximum. This regular relation, he allows, will probably hold good only within a comparatively limited zone, and will vary in other climatic regions. Applying the above relation to stations on the former limit of the hazel, he calculates the change required in one or other of the two factors on the assumption that the other has remained constant. Any number of intermediate variations of both are of course possible, and it is necessary to study the changes in the distribution of other plants, or of animals, in order to gain an idea of the most probable character of the change. Three main possibilities are open, viz. (1) that of a fall in the midsummer temperature without an essential change in the type of climate; (2) that of a change to a more continental type without a fall in the midsummer temperature;

(3) that of a change to a more maritime type, coupled with a fall in the midsummer temperature. It is therefore hardly likely that any very definite conclusions as to the nature of the change can be reached, but Mr. Samuelsson finds that almost all the established changes in the limits of plant-growth in Scandinavia can be explained on the supposition of a fall of about 1·5° C. in the midsummer temperature, coupled with a reduction of about fifteen days in the period of vegetation.

AFRICA.

Native Tradition on the Rhodesian Ruins.

The controversy as to the age of these ruins has been taken up by the Rev. S. S. Dornan, who in a paper printed in the *South African Journal of Science* for June last approaches the question mainly from the point of view of native tradition, which he says has not been sufficiently taken into account by previous writers. He justly insists on the extreme care necessary on the part of inquirers attempting to elicit trustworthy information on the past from natives, and especially on the need of avoiding leading questions, given the known readiness of natives to give any answer that may seem desired by the questioner. He has taken great pains to get at the truth by questioning aged individuals likely to be acquainted with past events, and has obtained statements appearing to him to entirely confirm the idea of the relatively modern character of the ruins, which he holds to be the work of the immediate ancestors of the peoples now living in South Africa, though not necessarily of those at present settled near the ruins, for the inroads of warlike peoples from outside have caused great shifting of population within recent times. Whilst no doubt justified in criticizing the attitude of those who have formed hasty and ill-founded conclusions as to the great antiquity and foreign origin of the ruins, Mr. Dornan perhaps shows, like Dr. Randall-MacIver, a certain bias in the opposite direction, for his paper is not entirely free from dogmatic assertion in matters that hardly admit of definite proof. The testimony of his native witnesses is not altogether convincing, and he himself allows that too much dependence must not be placed on certain parts of their story. This surely somewhat undermines confidence in the statements which he accepts as above suspicion. Moreover it seems possible that traditions of fortifications "built" by native chiefs within the memory of his informants may refer not to the original building, but to the adaptation of previously existing structures for defensive purposes. Mr. Dornan himself lays stress on the *gradual* destruction of the former civilization under successive attacks of barbarians, after each of which, he says, rebuilding and reconstruction would take place in the hurried manner which would account for decline in workmanship. All things considered, it is probably wisest to still suspend judgment—an attitude adopted among others by the trained Austrian ethnologist Dr. R. Pöch.*

AMERICA.

Seasonal and Regional Weather Types of the United States.

The well known climatologist Prof. R. de C. Ward treats of the "Weather Element in American Climates" in the *Annals of the Association of American Geographers*, vol. 4, 1914 [1916], wherein is reviewed the characteristic seasonal

* In referring to the credibility of old Portuguese writers, Mr. Dornan makes the statement: "I have read several of them, and do not attach more importance to their information than I do to Hakluyt's 'Voyages,' for example." This is a strange confession, especially at a time when the unrivalled value of the 'Voyages' as a mine of authentic information is being so justly celebrated.

weather types and sequences of the States as a whole and as locally modified by the major natural divisions of the country. Most of this lies well within the belt of prevailing westerly winds, one of whose marked characteristics is the dominance of the weather to a large extent by a continuous procession of cyclonic and anticyclonic eddies which are carried along in the general eastward drift of the atmosphere, so that the general character of the weather is changeable. To this extent the climate of North America resembles that of Western Europe ; but whereas the seasonal range of temperature in the British Isles is small and the change from day to day, though rapid, usually mild, in the United States not only is the seasonal range great, but the day to day changes are, at all events in winter, extremely drastic and severe. Thus in the New England states, where the temperature and general character of the weather is most variable, there may be a drop of some 50° Fahr. in the temperature within forty-eight hours as a winter cyclone passes over a station, with the attendant change of wind from south to north. Here in England on the other hand the drop of temperature between the front and rear of a winter cyclonic disturbance is considered big at 20°—say from 50° to 30° Fahr. instead of from 60° to 10° Fahr. as may occur in the U.S.A. in like circumstances. The winter storm tracks in the States are shown all to converge towards the north-eastern states, which thus experience more frequent storms than any other section of the Union. Prof. Ward justly lays great emphasis throughout his paper upon the cyclonic control of the weather in the winter months, and of solar control in the summer months when cyclones and anticyclones are more poorly developed and slow moving, and the general character of the weather governed more markedly by diurnal radiation. (Such differences are, of course, characteristic of temperate countries in general, and in the current issue of the *Q.J.R. Met. Soc.* the present writer has endeavoured to explain why it is that the strong radiation conditions of summer favourable to local convection currents are dynamically inconsistent with vigorous cyclonic circulation.) But inasmuch as the cyclonic and solar control of winter and summer weather types respectively show closer relationship with the monthly altitude of the sun than they do with the mean monthly temperature of the air, whose maximum and minimum lag, as is well known, about a month behind the solstices, it is matter for surprise that Prof. Ward should select the four months June—September instead of May—August to illustrate the summer solar control, and December—March instead of November—February to show the winter cyclonic control. Both in the United Kingdom and the United States statistics as well as general experience show that the season of violent summer land thunderstorms, which are perhaps the prime index of the direct solar control of weather, is conspicuously relegated to the four months May to August.

POLAR REGIONS.

Mr. Stefánsson's Expedition.

While the leader himself is remaining in the far north another winter, an eventuality contemplated by him as possible when he severed connection with the outside world more than a year ago (*Journal*, vol. 46, pp. 316, 459), the members of the southern party of the expedition, headed by Dr. R. M. Anderson, came south towards the end of the summer, and have supplied some details both of their own work and of the doings of Mr. Stefánsson since the date of his last communication. Good results appear to have been obtained from the work on the Arctic coast of Canada and Victoria Island to the north. They include surveys, topographical and geological, of the coast from Cape Parry

(on the mainland coast south of Banks Island) to Bathurst inlet (in 108½° west), including the whole shores of Coronation Gulf and portions of the rivers which debouch into it. One of these, the Rae river, which enters the western branch of the gulf, was examined for the first time for 75 miles from its mouth. The region of Bathurst Inlet will receive considerable corrections on the map as a result of the surveys, a large number of smaller islands taking the place of the three large ones hitherto placed off the western entrance to the inlet. A complete meteorological record was kept during the three years' stay of the expedition in these regions, and other work includes soundings and deep-sea dredgings, tidal observations at the winter quarters in Dolphin and Union Strait, natural history collections (about a thousand specimens of mammals and birds), as well as many photographs and cinematograph pictures. Mr. D. Jenness, the ethnologist of the southern party, was very active in investigating the migrations, habits, and folk-lore of the Eskimo, including those of Victoria Land, among whom he lived and travelled extensively. It will be remembered that a good deal of interest was aroused on Mr. Stefánsson's return from his previous expedition by his report of the discovery of a blonde race of Eskimo on this island, and valuable new facts appear to have been collected about them. Mr. G. H. Wilkins, the photographer of the expedition, who reached this country towards the end of October, has given some details of his experiences with these people in an interview with Reuter's representative published in the *Daily Chronicle* of October 25. He also speaks of the discovery in the Bathurst Inlet area of important new deposits of native copper. As regards Mr. Stefánsson's own movements, it is stated that the *Polar Bear*, the new vessel bought by him in 1915 for his northern work, wintered near Princess Royal Island, between Banks and Victoria Islands, after a vain attempt to sail up the west side of the former. In May of this year the expedition for the further examination of the new land north of Prince Patrick Island, discovered by Mr. Stefánsson in 1915, was begun. Mr. Wilkins—who seems to have joined Mr. Stefánsson after completing his journeys in Victoria Island, finally parting from him in April last—received from him in May a letter brought by a returning support party, which stated that he was then travelling on the north-west coast of the new land with a view to determining its extent.

Coal in Bear Island.

The attempts made in the past few years to exploit the coal resources of Spitsbergen are being extended, it appears, to the solitary Arctic outpost of Bear Island, between Spitsbergen and Norway. According to a note in the *Bolletino* of the Italian Geographical Society for November, a party of forty persons commenced operations during the past summer, and a steamer has already brought back a cargo of coal. The deposits, which occur on the northern side of the Island, have a greater extension than had been supposed. The Norwegian Government is said to intend establishing a meteorological and wireless station on the island.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

An Exceptional Form of Reef-encircled Islands.

In a paper contributed to the *Proceedings of the National Academy of Sciences, U.S.A.* (May, 1916), Prof. W. M. Davis discusses what he shows to be an exceptional form of island in the Coral Seas—one, *i.e.*, in which, as in

the case of Réunion or Tahiti, the shore-line ends, in whole or in part, in cliffs instead of presenting an indented outline with tapering spurs and branching bays, as is the case with the large majority of reef-encircled islands. In this more usual case the encircling barrier reefs have grown upwards from their beginning as fringing reefs during the subsidence which gave to the shore its indented outline. On the basis of Darwin's theory of intermittent subsidence, Prof. Davis examines the probable course of events by which an original volcanic island is gradually modified into a reef-encircled island of normal type, and finds that the same sequence of events may well explain the origin of the less usual form. He shows that in the early stages of dissection the completed volcanic island will be cut into cliffs by the action of the waves, which will have to deal with so abundant a supply of detrital matter that a continuous offshore detrital sheet will be formed, and will be maintained as long as the island stands still; and that the growth of corals is thereby greatly discouraged if not entirely prevented. With subsidence the shore-line will cross the cliff at mid-height and enter the larger valleys in the embayments of which the land detritus will be pocketed. Wave erosion will be less effective and a fringing reef can now be formed; this will hold up such detritus as is derived from the cliff face, and allow the outer rock platform to be exposed and a barrier reef to grow up; further intermittent subsidences carrying the process further, until an atoll may result. Réunion and Tahiti are held to represent successive early stages in the course of development. The former is partially cliffed, with hanging valley mouths, but no embayments, and coral reefs form only fragmentary fringes. Tahiti has cliffs nearly all round, but the embayment of the larger valley mouths points to subsidence. Most of the embayments are now filled with deltas, which advancing into the lagoon form a narrow alluvial plain on which most of the population dwells. Subsidence has thus been followed by a period of quiescence, permitting the partial enclosure of the island by a barrier reef. Prof. Davis holds that the subsidence theory thus gains strong support when an extension of its postulated conditions and processes enables it to account for exceptional and otherwise not easily explained features.

GENERAL.

George Chaworth Musters.

Through the generosity of Mr. Patrick Musters, of Annesley Park, Nottingham, a fine portrait of his uncle, George Chaworth Musters (an enlarged photograph), has been secured for the collection of portraits of explorers at Lowther Lodge. George Chaworth Musters was the most distinguished of the early modern explorers of Patagonia in the second half of the nineteenth century. Spanish explorers and missionaries had had intercourse with the Patagonian plains from the Chilean side for three centuries before this, but their reports were not generally accessible. Byron and Wallis had left some thrilling reminiscences of the extreme south; Falkner, Viedma, and Villarino had done good work from the east in the same century; Fitzroy, Darwin, and Cunningham in the nineteenth had also investigated the fringe of the country before Musters in 1869 made his extraordinary journey through the midst of it from Santa Cruz to Nahuel Huapi and Patagones. It was this which gave us our first complete view of the interior of the country about the foothills of the Andine Cordillera, and displayed to us in detail the social life of the Tehuelche, Pampas, and a section of the Araucanian Indians. Musters travelled with the Tehuelches, lived in the "toldo" of a chief, joined in their sports and adventures, risked his life all the way in a company of excitable aborigines who had

no idea whatever that human life is in any way sacred ; and, as we may gather from suggestions contained in his narrative, annexed a Tehuelche wife. It is sometimes instructive to read again an old story of adventures such as this if only for the purpose of noting the opinions and observations of the traveller and comparing them with those of subsequent observers when the theatre of travel has become better known. It sets a standard, as it were, for the general trustworthiness of the author. One cannot read the tale told by Musters nearly half a century after it was written without being struck by the remarkable powers of observation which he displayed, and the extraordinary acuteness of his perceptions as regards the moral position in the scale of humanity and the idiosyncrasies of the Patagonian Indians. Of the chief with whom he lived (and who was not free from a suspicion of a wish to kill him on one occasion) he says that he was frank, honest, generous, and sober, and in every way fit for a chief. He was a skilled workman in all Indian trades, but an inveterate gambler. As a rule, however, drink was the curse of the community, and the innate ferocity which it frequently stirred up was the cause of much diminution in the numbers of the tribe. He notes the advance in civilization which was (and is still) a marked feature amongst the Araucanians as compared with the Tehuelches ; and he very shrewdly foretells the end of Patagonian Indian freedom. There is not a word in the book which is not justified by the experiences of subsequent travellers, and it will undoubtedly remain as the standard record of a most interesting people who are rapidly disappearing from the face of the Earth.

CORRESPONDENCE.

Plains, Peneplains, and Peneplanes.

SINCE the reading of the paper published in the last number of the *Journal* the nature and nomenclature of peneplanes has been discussed by Prof. D. W. Johnson in an important article (*Geographical Review*, June 1915, pp. 443–447) which affords abundant evidence of the present indefiniteness of the term "peneplane." His proposed use of the term is given in the three following definitions : "(1) The level erosion surface produced in the ultimate stage of any cycle may be called a *plane*. (2) The undulating erosion surface of moderate relief produced in the penultimate stage of any cycle may be called a *peneplane*. (3) A low-relief region of horizontal rocks would, as now, be called a *plain*." Prof. Johnson therefore uses the term in a much wider sense and farther from the meaning of its original author, Prof. Davis, than that suggested in my paper. Prof. Johnson also adopts the spelling "peneplane," which he recommends both from its greater practical utility and its better literary form. He quotes the spelling "peneplane" by various American authorities.

I originally adopted that spelling in deference to the wishes of a British authority whose literary judgment is as weighty as his geographical judgment. The spelling "peneplane" has always seemed to me preferable, and though in my paper I accepted peneplain in accordance with the custom of the *Geographical Journal*, I shall continue to use peneplane whenever permitted.

J. W. GREGORY.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1916–1917.

First Evening Meeting, 6 November 1916.—The President in the Chair.

PAPER: The Great Passes of the Western and Central Alps. The President.

First Afternoon Meeting, 9 November 1916.—Sir Thomas Holdich, Vice-President, in the Chair.

PAPER: Natural Divisions of England. C. B. Fawcett.

GEOGRAPHICAL LITERATURE: ADDITIONS TO THE LIBRARY. Edward Heawood, Librarian, R.G.S.

For list of abbreviations see January number.

EUROPE.

Adriatic—Political. *Riv. G. Italiana* **23** (1916): 91–112. **Revelli.**
Una questione di geografia politica. L'Adriatico e il dominio del Mediterraneo orientale. By Paolo Revelli.

Adriatic—Vegetation. *Riv. G. Italiana* **23** (1916): 65–90, 177–193. **Béguinot.**
I distretti floristici della regione littoranea dei territori circumadriatici. By Augusto Béguinot. *Illustrations.*

Alps—Col de Tenda. **Coolidge.**
The history of the Col de Tenda. By W. A. B. Coolidge. (Reprinted from *The English Historical Review*, vol. **31**, April 1916.) [London], 1916. Size 10 × 6, pp. 193–405.

Alps—Glaciation. *Z. Gletscherkunde* **9** (1916): 225–269, 306–348. **Levy.**
Die eiszeitliche Vergletscherung der Südalpen zwischen Dora Riparia und Etsch. Eine prinzipielle stratigraphische Untersuchung. Von Fr. Levy. *Illustrations.*

Alps—Political. *Riv. G. Italiana* **23** (1916): 153–176. **Lorenzi.**
La funzione politica delle Alpi. By Arrigo Lorenzi.

Austria—Ethnology. *Petermanns M.* **62** (1916): 136–138. **Sieger.**
Nationale Verschiebungen durch die Binnenwanderung in Österreich. Von Robert Sieger.

Austria—Trentino. *La G.* (*Novara*) **4** (1916): 186–193. **Correnti.**
Le frontiere italiane: il Trentino. By Cesare Correnti.

Balkan Peninsula—War. *G. Rev.* **2** (1916): 27–47. **Johnson.**
The Balkan Campaign. By Douglas Wilson Johnson. *Map and Illustrations.*
Traces the influence of geography on the campaign of 1915.

Eastern Europe—War. *G. Rev.* **1** (1916): 85–109. **Johnson.**
The great Russian retreat. By Douglas Wilson Johnson. *Maps and Illustrations.*
Traces the influence of land-forms in the Russo-German campaign of 1915.

Europe—Hydrology. *Petermanns M.* **62** (1916): 138–139. **Henkel.**
Gegensätze im Wasserhaushalt nordischer und mitteleuropäischer Flüsse. Von Ludwig Henkel.

Europe—Northern Waters. **Mecking.**
G.Z. **22** (1916): 297–315, 372–393.
Der nördliche Seekriegsschauplatz (Ostsee, Nordsee und Kanal). Von Ludwig Mecking.

Europe—War. *J.G.* **14** (1916): 373–384. **Ward.**
The weather factor in the great war: IV. By Robert de C. Ward.

Rumania—Danube—Fen. *J. Linnean S.*, 43, *Botany* (1916): 233–290. **Pallis.**
The structure and history of Plav: the floating fen of the delta of the Danube. By Marietta Pallis. *Illustrations and Map.* [Also separate copy.]
See note in the Monthly Record, October, p. 351.

Russia—Bessarabia. *Petermanns M.* 62 (1916): 161–167. **Lehmann.**
Bessarabien. Eine landeskundliche Uebersicht. Von F. W. Paul Lehmann.

Russia—Podolia. *Ann. G.* 25 (1916): 116–123. **Himner.**
Contribution à l'étude de la Podolie russe: les méandres encaissés et les conditions du peuplement. Par M. Himner. *Illustration.*

South-east Europe—Ethnology. **Hinković.**
Les Yougoslaves. Leur passé—leur avenir. (Extrait de la *Revue Anthropologique* de juin 1916.) By H. Hinković. Paris, 1916. *Map, Portrait, and Facsimile.*

Spain—Geology. **Hernández-Pacheco.**
Rev. R.A. Ciencias, Madrid 13 (1914): 86–96.
Régimen geográfico y climatológico de la meseta castellana durante el mioceno. Por Eduardo Hernández-Pacheco.

Switzerland—Guide. **Tschudi and Taüber.**
Der tourist in der Schweiz und Grenzgebieten. Reisetaschenbuch von Iwan von Tschudi. Fünfunddreissigste Auflage. Neu bearbeitet von Dr. C. Taüber. Band I. Nordschweiz und Westschweiz. Zurich: Orell Füssli, 1916. Size 6 × 4, pp. xl. and 194. *Maps, Plans, and Illustrations. Price* 3*s.* 6*d. Presented.*

Switzerland—Märjelen Lake. **Lütschg.**
Le lac de Märjelen. By O. Lütschg. Geneva, 1916. Size 9 × 5½, pp. 32. *Illustrations.*

Turkey—Dardanelles. *Z. Ges. E. Berlin* (1916): 193–221. **Von Diest.**
Die Dardanellen im Weltkrieg. Von v. Diest. *Illustrations and Map.*

United Kingdom—Glasgow District—Geology. **Gregory and others.**
The geology of the Glasgow district. By J. W. Gregory and others. [Reprinted from *Proc. Geologists' Assoc.*, vol. 26, part 3, 1915.] London, 1915. Size 8½ × 5½, pp. 151–194. *Sketch-maps and Illustrations.*

ASIA.

Aden—Botany. *Records Botanical Surv. India* 7 (1916): 337–418. **Blatter.**
Flora of Aden. By Ethelbert Blatter. *Map and Illustrations.*

Arabia. *Scottish G. Mag.* 32 (1916): 321–330, 366–373. **Dingelstedt.**
Arabia and the Arabs. By V. Dingelstedt.

Central Asia—Lamaism. *G. Ts.* 23 (1916): 225–237. **Schönebeck.**
Lamavældet i Centralasien. Af Alfred Schönebeck. *Illustrations.*

Central Asia—Travel. **Obrucheff.**
Sketch of the journeys of D. A. Klementz in the interior of Asia and their geographical and geological results. By V. A. Obrucheff. (From the *Izvyestia E. Siberian Sect., Imp. Russian G.S.*, vol. 45.) Irkutsk, 1915. Size 10 × 7, pp. 34. *Map and Portrait.*

China—Commercial. **Powell.**
Transportation in China. By Sidney J. Powell. (The Engineering Society of China. Session 1915–1916.) Shanghai, etc.: Kelly & Walsh, Ltd., 1916. Size 8½ × 5½, pp. 18.

AFRICA.

Central Africa—Lakes—Historical. **Langenmaier.**
Petermanns M. 62 (1916): 10–12, 55–58, 132–136.
Die Darstellungen der zentralafrikanischen Seenregion von Ptolemäus bis d'Anville. Von Theodor Langenmaier. *Maps.*
See note in the Monthly Record, May, p. 383. The author indulges in somewhat fantastic speculations as to the identity of features shown in old maps.

Morocco—Shott Tigri. *Ann. G.* 25 (1916): 181–190, 291–302. **Gautier.**
Le chott Tigri. By E. F. Gautier. *Map and Illustrations.*

Nigeria. *P.R.G.S. Australasia, S. Austr. Branch* **16** (1916): 77–105. **Galway.**
Pioneering in Nigeria. By H.E. Lieut.-Colonel Sir Henry Galway.

North Africa—Archæology. *G. Ts.* **23** (1916): 205–224. **Olufsen.**
Muhammedanske Grave og Gravminder i Sahara og Tunisien. Af Ole Olufsen. *Illustrations.*

Rhodesia—Archæology. *South African J. Sc.* **12** (1916): 502–516. **Dornan.**
Rhodesian ruins and native tradition. By S. S. Dornan. *Illustrations.*
Native tradition is called in to prove that the Rhodesian ruins were built by the ancestors of the present inhabitants, no very long time ago (*see* p. 510, *supra*).

Transvaal—Ethnology. *South African J. Sc.* **12** (1916): pp. 241–256. **Roberts.**
The Baganano or Ma-laboch: notes on their early history, customs, and creed. By Noel Roberts. *Illustrations.*

NORTH AMERICA.

Canada—Rocky Mountains—Phosphate. **Adams and Dick.**
Commission of Conservation, Canada. Discovery of phosphate of lime in the Rocky Mountains. By Frank D. Adams and W. J. Dick. Ottawa, 1915. Size 10 × 7, pp. 36. *Maps and Illustrations.*
The discovery of phosphate rock in the Canadian Rockies in a site analogous to those further south in the United States may prove of great economic importance by reason of the urgent need of phosphates for agriculture. The paper discusses briefly the present phosphate resources of the world.

United States—California—Lassen Peak. **Diller.**
B. Seismol. S. America **6** (1916): 1–7.
Lassen Peak—Our most active volcano. By J. S. Diller. *Illustrations.*
Cf. note in the August number, p. 173.

United States—Geological Survey. **Dept. of Interior.**
Thirty-sixth annual report of the director of the United States Geological Survey to the Secretary of the Interior for the fiscal year ended June 30, 1915. Washington, 1915. Size 9 × 6, pp. 186. *Maps.*

United States—Guide. **Campbell and others.**
U.S. Geol. Surv., B. 611 (1915): pp. 212.
Guidebook of the Western United States. Part A: The Northern Pacific route. With a side trip to Yellowstone Park. By Marius R. Campbell and others. *Maps and Illustrations.*

United States—Guide. **Darton and others.**
U.S. Geol. Surv., B. 613 (1915): pp. iv., 194.
Guidebook of the Western United States. Part C: The Santa Fe route. With a side trip to the Grand Canyon of the Colorado. By N. H. Darton and others. *Maps and Illustrations.*

United States—Guide. *U.S. Geol. Surv., B.* 614 (1915): pp. 142. **Diller and others.**
Guidebook of the Western United States. Part D: The Shasta route and coast-line. By J. S. Diller and others. *Maps and Illustrations.*

United States—Utah. *G. Rev.* **1** (1916): 346–358. **Jefferson.**
Utah, the oasis at the foot of the Wasatch. By Mark Jefferson. *Maps and Illustrations.*

United States—Washington. *J.G.* **14** (1916): 309–322. **Saunders.**
The physical geography of Washington. By E. J. Saunders. *Map.*

United States—Washington—Cities. *J.G.* **14** (1916): 348–353. **Gregory.**
The growth of the cities of Washington. By W. M. Gregory.

United States—Washington—Spokane. *J.G.* **14** (1916): 356–361. **Buchanan.**
The Spokane country: its industries and cities. By J. E. Buchanan.

CENTRAL AND SOUTH AMERICA.

Chile—Antofagasta. *La G. (Novara)* **4** (1916): 164–186. **Ormezzano.**
Antofagasta. By Vincenzo Ormezzano.

Danish West Indies. *National G. Mag.* **30** (1916): 89–96. ——
An American Gibraltar. Notes on the Danish West Indies. *Illustrations and Map.*

Mexico. *National G. Mag.* **30** (1916) : 1–32. **Prescott.**
The luster of ancient Mexico. By William H. Prescott. *Illustrations.*

Mexico—Guanajuato. *National G. Mag.* **30** (1916) : 33–68. **Probert.**
The treasure chest of mercurial Mexico. By Frank H. Probert. *Illustrations.*

Mexico—Xochimilco. *National G. Mag.* **30** (1916) : 69–88. **Hough.**
The Venice of Mexico. By Walter Hough. *Illustrations.*

Peru—Anthropogeography. *G. Rev.* **1** (1916) : 419–442. **Bowman.**
The country of the shepherds. By Isaiah Bowman. *Map and Illustrations.*

South America—Hydrography. ——
Anuario Hidrográfico Marina Chile **29** (1915) : 3–348.
Esploraciones y viajes. [Account of different hydrographic voyages in South American waters.] *Maps and Plans.*

AUSTRALASIA AND PACIFIC ISLANDS.

South Australia—Expedition. **White and others.**
T. and P.R.S. South Australia **39** (1915) : 707–842.
Scientific notes on an expedition into the north-west regions of South Australia. By S. A. White and others. *Maps and Illustrations.*
The expedition, which Mr. White accompanied in an unofficial capacity, started in June 1914. After the narrative separate sections deal with the anthropology and natural history.

POLAR REGIONS.

Arctic—Oceanography. **Nansen.**
Spitsbergen Waters. Oceanographic observations during the cruise of the *Veslemöy* to Spitsbergen in 1912. By Fridtjof Nansen. (*Videnskapsselskapets Skrifter.* I. Mat.-Naturv. Klasse, 1915, No. 2.) Christiania, 1915. Size 11 × 7, pp. 132. *Illustrations and Maps.*

Spitsbergen—Wood Fjord. *Ymer* (1916) : 156–162. **De Geer.**
The Head of Wood Fjord. By Gerard de Geer. *Maps.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Meteorology. *Q.J.R. Meteor. S.* **42** (1916) : 137–152. **Shaw.**
The meteorology of the globe in 1911. By Sir Napier Shaw. *Illustrations.*

Phytogeography. *G.Z.* **22** (1916) : 328–334. **Engelbrecht.**
Ueber die Enstehung einiger feldmässig angebauter Kulturpflanzen. Von Th. Engelbrecht.

Seismology. *G.Z.* **22** (1916) : 315–328. **Tams.**
Ueber die Intensitätsverhältnisse in den Schüttergebieten starker Erdbeben. Von E. Tams. *Illustrations.*

Terrestrial Magnetism. *J. Franklin I.* **181** (1916) : 601–628. **Bauer.**
Our Earth a great magnet. By L. A. Bauer. *Illustrations.*

Terrestrial Magnetism. **Bauer and Fisk.**
Terrestrial Magnetism, etc. **21** (1916) : 57–86.
On the results of some magnetic observations during the solar eclipse of August 21, 1914. By L. A. Bauer and H. W. Fisk. *Sketch-maps and Illustrations.*

GENERAL.

Geography. *Z. Ges. E. Berlin* (1916) : 158–176, 222–248. **Penck.**
Der Krieg und das Studium der Geographie. Von Albrecht Penck.

Mountaineering. **Täuber.**
Auf Fremden Bergpfaden. Von Dr. C. Täuber. Zurich : Orell Füssli, [1916]. Size 8½ × 5½, pp. 514. *Illustrations. Presented.*

Mountaineering—Hints. **Swiss Alpine Club.**
Ratgeber für Bergsteiger herausgegeben von der Sektion "Uto." Mit Beiträgen von F. Becker, E. Erb, J. Fritsch, etc. Zurich : Orell Füssli, [1916]. Size 7½ × 5, pp. (Bd. i.) viii. and 298 ; (Bd. ii.) 116. *Illustrations and Diagrams.*

NEW MAPS AND PHOTOGRAPHS: ADDITIONS TO THE MAP ROOM.

E. A. Reeves, Map Curator, R.G.S.

EUROPE.

British Isles. **Bacon.**

Bacon's Commercial Map of Great Britain, showing all Railways and Stations, Canals, Navigable Rivers, Main Roads and Steamship Routes. Scale 1 : 554,400 or 1 inch to 8·75 stat. miles. Size 58 by 38 inches. London: G. W. Bacon & Co., Ltd., 1916. *Price 21s. net. Presented by the Publishers.*

The railways are clearly indicated on an outline without hills, lightly printed in grey, with names in the same colour; and the different systems and companies are shown by various colours and symbols. A complete table of reference is given at the side, together with the length of mileage for each company. Canals, main roads, limit of navigation of rivers, and coalfields are all well indicated. Numerous insets on enlarged scales are given of special districts, and altogether this promises to be a useful map to those interested in the matters with which it deals.

Europe. **Philip.**

Philips' Large-scale Battle Front map of Europe. Equatorial scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. Size 34 by 40 inches. London: George Philip & Son, Ltd., 1916. *Price 2s. 6d. net. Presented by the Publishers.*

A map of the greater part of Europe on Mercator's projection, showing the enemy countries in green, the neutral countries in yellow, and the countries of the Allies in red. Bold black lines, in different symbols, indicate the battle fronts at the beginning of the Russian offensive, 4 June 1916, the battle fronts on 27 August 1916 (the date of Rumania's entry into the war), and the Allies' lines of Naval blockade in August. Steamship lines, telegraph cables, and other information is also given. A more suitable projection than Mercator's might have been selected for the map.

ASIA.

Russia—Caucasus. **R.G.S. and G.S.G.S.**

Asia 1 : 1,000,000 (1 inch to 15·78 stat. miles). Sheet (Provisional Edition) North K 38, Tiflis. Compiled at the Royal Geographical Society under the direction of the Geographical Section, General Staff. Drawn and printed at the War Office, 1916. G.S.G.S. No. 2555. London Agents: E. Stanford, Ltd.; Sifton, Praed & Co.; T. Fisher Unwin. *Price 1s. net. Presented by the Director of Military Intelligence.*

This sheet extends from 40° to 44° N. lat. and from 42° to 48° E. long. Contours are at 200 and 500 metres, and thence at 500-metre intervals.

Turkey. **Geographical Section, General Staff.**

Lower Mesopotamia from Baghdad to the Persian Gulf. Scale 1 : 1,000,000 or 1 inch to 15·78 stat. miles. Geographical Section, General Staff, No. 2563. Additions and corrections, August 1916. *Price 2s. 6d. net. Presented by the Director of Military Intelligence.* London Agents: E. Stanford, Ltd.; Sifton, Praed & Co.; T. Fisher Unwin.

This map extends from latitude 29° to 34° N. and from 43° 30′ to 49° 30′ E., and thus includes the lower courses of the Euphrates and Tigris from a few miles north of Baghdad to the head of the Persian Gulf, with the adjacent portions of Arabia and Persia. It has been considerably revised and added to since the first edition was published in 1907, and a list of the data utilized in the revision is given. It is an important map at the present time, since it embraces the whole field of the British operations in Mesopotamia.

AMERICA.

Canada. **Dept. of the Interior, Ottawa.**

Map of Manitoba, Saskatchewan, and Alberta, showing the number of quarter sections available for homestead entry in each township, also the pre-emption and purchased homestead area as defined by the Dominion Lands Act, 1908. Scale 1 : 2,217,000 or 1 inch to 35 stat. miles. Prepared in the Railway Lands Branch under the direction of F. C. C. Lynch, Superintendent. 5th edit. 1916. Size 21 by 33 inches. Ottawa: Department of the Interior, Railway Lands Branch, 1916. *Presented by the Department of the Interior.*

Canada. **Dept. of the Interior, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 18, Wood Mountain, Saskatchewan, 6th edit., 1916; 118, Rush Lake, Saskatchewan, 7th edit., 1914; 171, Duck Mountain, Manitoba, 7th edit., 1915. Size 17 by 32 inches. Ottawa: Department of the Interior, 1914–16. *Presented by the Department of the Interior.*

Peru. **Guevara and Vallejos.**

Mapa Ferroviario del Peru. Trazado por disposicion del Sr. Ministro de Fomento Dr. Dn. Belisario Sosa bajo la direccion del Ingeniero D. Alejandro Guevara, Director del Cuerpo de Ingenieros Civiles por el Cartografo de la Sociedad Geografica D. Camilo Vallejos Z. Scale 1 : 2,500,000 or 1 inch to 39·5 stat. miles. Size 37 by 25 inches. Lima, 1916. *Presented by Sr. E. de la Fuente, Peruvian Consul-General in London.*

An outline map, with rivers in blue, showing in red lines of various symbols, railways working, under construction, surveyed and projected, with stations according to their importance. No attempt has been made to indicate relief.

AUSTRALASIA.

Australia. **Commonwealth Meteorological Bureau.**

Two models representing the (1) Rainfall and (2) Physiographical Features of Australia. Prepared at the Commonwealth Meteorological Bureau, under instructions from the Hon. King O'Malley, M.P., Minister of State for Home Affairs. H. A. Hunt, Commonwealth Meteorologist. Melbourne, 1916. *Presented by Mr. H. A. Hunt.*

These are two plaster models of Australia on the horizontal scale of 1 : 8,426,880 or 1 inch to 133 miles, and measuring 22½ by 18¾ inches.

The rainfall model shows the amount of rain that falls annually on various parts of the continent by means of a combination of vertical relief, on the scale of 10 inches to a centimetre, and the usual system of contours and tints of blue, increasing in density with the amount of precipitation. The effect of this is that in the eastern districts where there is most rain there are remarkably high pinnacles of water with bands of blue darkening with their height, and where there is very little rain, such as in the central parts, the whole appears as a flat plain and is left uncoloured. The contours and tints representing the rainfall are at intervals of 10 inches, from 0 to 10 inches being left white, and from 150 to 160 inches, on the tops of the pinnacles, being shown by dark blue.

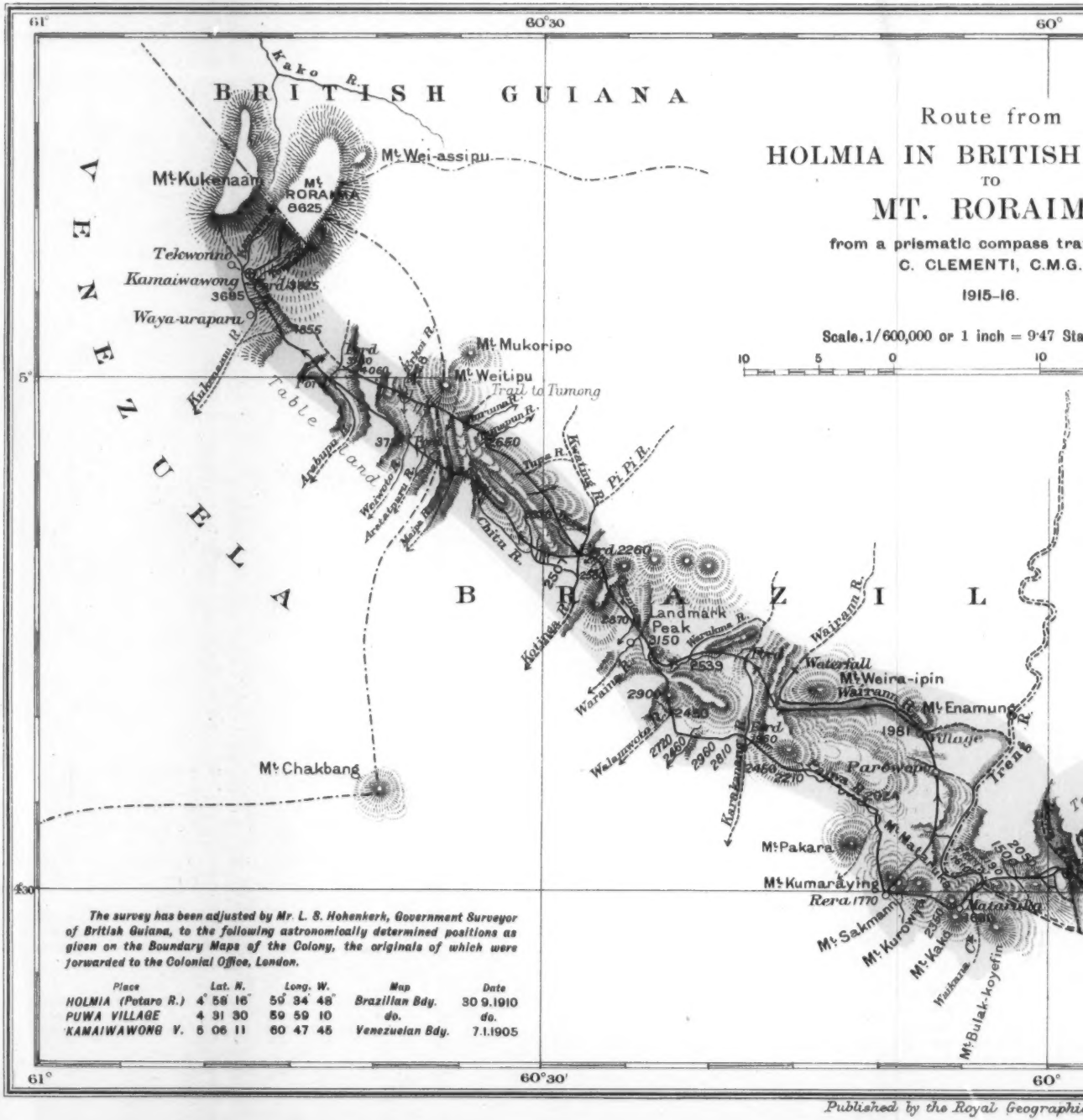
This system is certainly graphic, but owing to the great difference between the vertical scale for showing the amount of rainfall and the horizontal scale of the model, it seems likely to convey a greatly exaggerated idea of the amount of water that really falls on different parts of the continent; it would require only a few of these high pinnacles of water to flood the continent. A much smaller vertical scale would have answered the purpose and been less likely to mislead.

Still it is an interesting model, and a great deal can, with care, be learnt from it, although its advantages over the ordinary method of representing rainfall by layer-tinted maps are perhaps after all somewhat doubtful.

On the model is also a rainfall map of the British Isles on the same horizontal scale, and a table showing the comparison between the total area of the British Isles and the different rainfall areas of Australia shown by the grades on the model.

The second model shows the chief physiographical features of the continent, and is intended as a companion of the rainfall model. The vertical scale is 1 inch to 4000 feet, which gives an exaggeration of about 175 times the horizontal, and is excessive. The Federal capital, Canberra, seems perilously placed on the steep side of a gorge. The coastal, Salt Lake, and Murray River systems, and the rainless area, are all shown by various tints. Railway lines existing, under construction and approved, are indicated, as are also steamship routes and lighthouses. This model has been prepared under the direction of Mr. H. A. Hunt, the Commonwealth Meteorologist, by Mr. M. J. Curtin, from contours and data by Dr. Griffith Taylor.

N.B.—It would add greatly to the value of the collection of Photographs which has been established in the Map Room if all the Fellows of the Society who have taken photographs during their travels would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



Published by the Royal Geographi

rom

TISH GUIANA

AIMA

ass traverse by
C.M.G.

9·47 Statute Miles.

10 20 Miles

Altitudes from mean readings of boiling-point thermometer and aneroid shown thus 8625, and by aneroid alone thus 1500.

Forest areas coloured green. Savannah areas yellow.
Route traversed shown thus ——— *Deviations on outward journey* ←——— *Other trails* - - - - - -
Camps —×—×— *Villages* ○

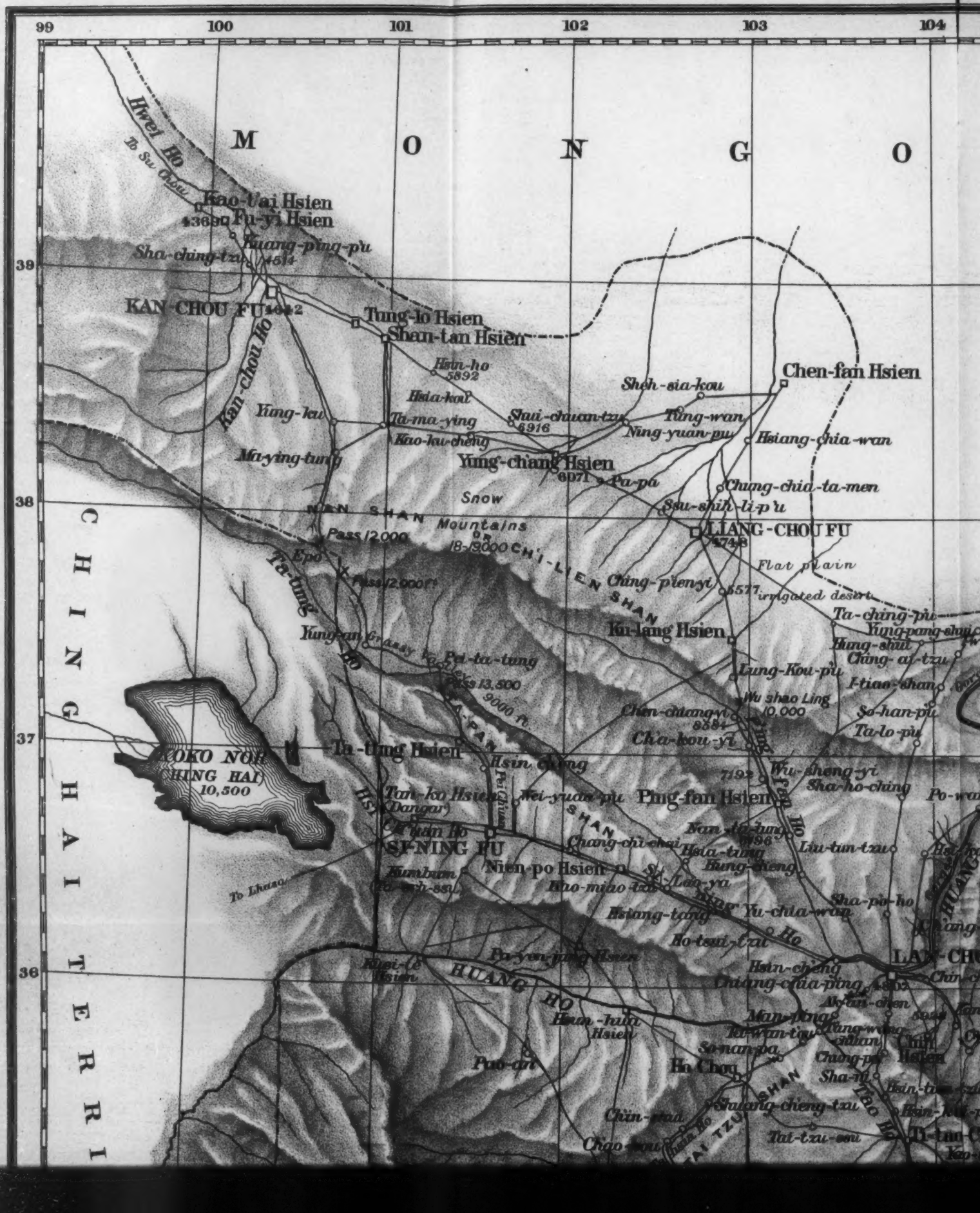
60° 59°30' 59° 5°

POTARO RIVER
Kaieteur Fall
(Kaietuk)
Holmia 1480
Tumong trail
Wong Creek
Ford
1510
1550
Trail to Arnik
Chenapowru R.
Arabana
B R I T I S H
Mt Kowatipu
2730
2937
2005
Eccangalong
2240
Kowa R.
G U I A N A
Trail to Arnik
Essequibo Amazon divide
Ford
Kwakwatutoi
Barimakatot 2676
Kwakwatutoi
2500
Kasabalting
High Table Land
2406
MENZIES
TABLE LAND
2200
Kowa R.
Tawong R.
Trail to Paparuma
Ireng R.
60° 59°30'

Scale, 1/10000,000.
Orinoco R.
VENEZUELA
ATLANTIC OCEAN
Georgetown
Cuyuni R.
Mazaruni R.
Demerara R.
BRITISH
Mt Roraima
Holmia
Barima R.
Pomeroon R.
DUTCH GUIANA
GUIANA
Ireng R.
Takutu R.
Rio Branco
Essequibo R.
BRAZIL

ographical Society.

BRITISH GUIANA
Clementi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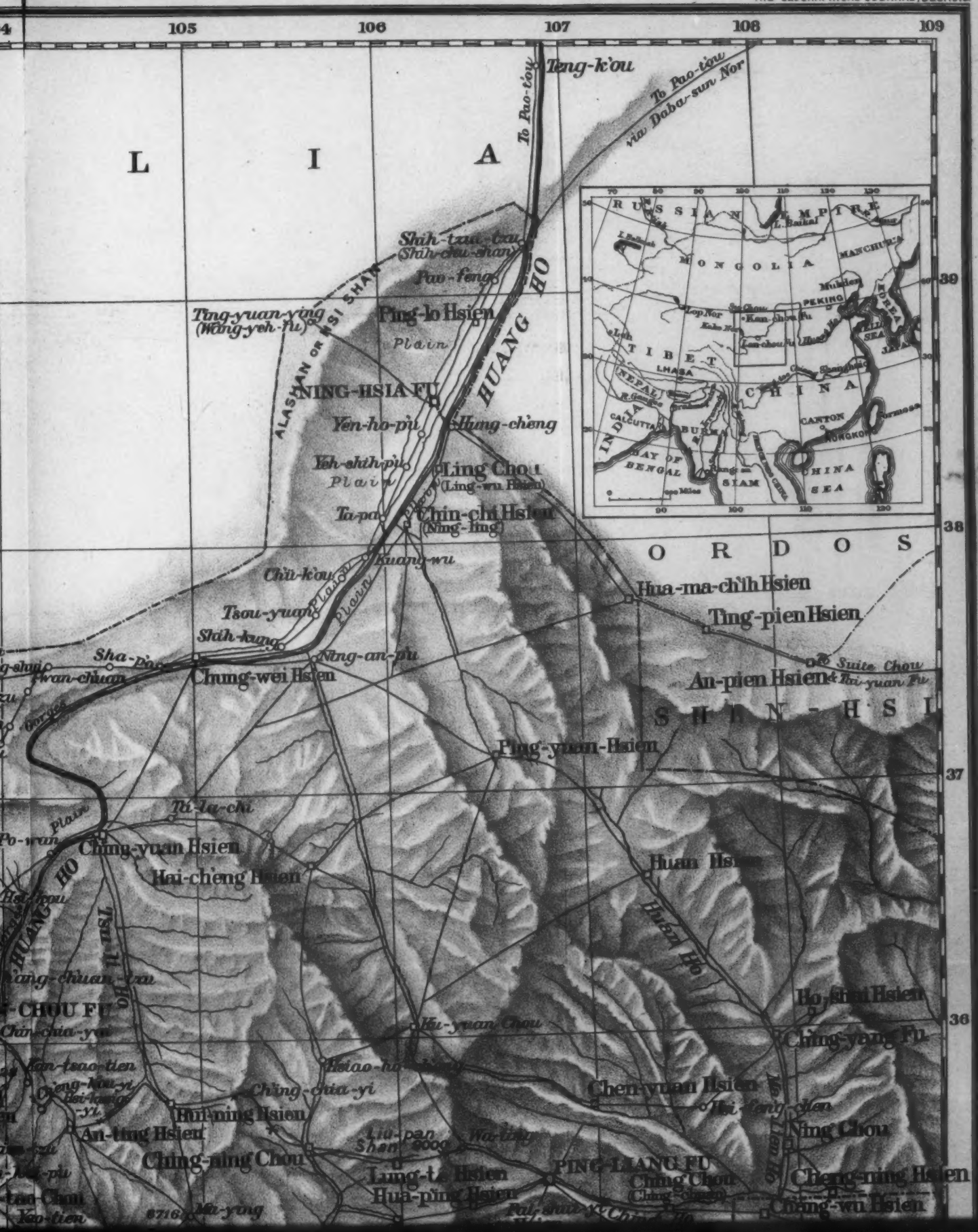
MONGO
Hwei Ho
To Su Chou
Kao-Vai Hsien
Fu-yi Hsien
Kuang-ping-p'u
Sha-ching-tzu
KAN-CHOU FU
Tung-lo Hsien
Shan-tan Hsien
Kan-chou Ho
Hsin-ho
5892
Hsia-kai
Yang-kai
Ta-ma-ying
Kao-ku-cheng
Ma-ying-tung
Shui-chuan-tzu
6916
Sheh-sia-kou
Chen-fan Hsien
Tung-wan
Ning-yuan-pu
Hsiang-chia-wan
Yung-chang Hsien
6071
Pa-pa
Chung-chia-ta-men
Snow
NAN SHAN Mountains
Pass 12,000
OR
18-19,000
Ssu-shih-li-p'u
LIANG-CHOU FU
5743
Flat plain
irrigated desert
CHI-LIEN SHAN
Ching-p'ing-yi
5577
Ta-ching-pu
Yung-pang-shan
Ku-lang Hsien
Hung-shui
Chang-ai-tzu
Ta-tung Ho
Kung-fan Grassy Pass 12,000 ft.
Pei-ta-tung
Pass 13,500
9000 ft.
Lung-Kou-pu
I-tiao-shan
Wu shao Ling
10,000
Chen-chang-yi
8584
So-han-pu
Ta-lo-pu
Cha-kou-yi
KOKO NOR
HING HAI)
10,500
Ta-tung Hsien
Hsin-chang
Pei Chuan
Wu-sheng-yi
7192
Sha-ho-ching
Tan-ka Hsien
(Dangar)
Wei-yuan-pu
Ping-fan Hsien
Hsi Ch'uan Ho
SI-NING FU
Nan-ta-tung
7196
Chang-chi-chai
Hsia-tung
Liu-tun-tzu
Nien-po Hsien
Hung-cheng
Kao-miao-tzu
Lan-ya
Yu-chia-wan
Sha-po-ho
To Lhasa
Kumbum
Hsiang-tang
Ho-tsui-tzu
Ho
Pa-yen-jung Hsien
Kuei-te Hsien
HUANG HO
Hsin-ching
Chiang-chia-ping
Hsun-hua Hsien
Man-ping
Pao-an
Ha Chou
Sha-ti
Shuang-cheng-tzu
Chün-tzu
Chao-tzu
Tai-tzu-su
TAO Ho
TAI TZU SHAN
CHING HAI TERRI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L I A
O R D O S
S H E N - H S I
Teng-k'ou
To Pao-t'ou
To Pao-t'ou via Daba-sun Nor
Shah-tzuu-tzu (Shah-chu-shan)
Pao-feng
Ping-lo Hsien
Plain
HUANG HO
ALASHAN OR HSI SHAN
Ting-yuan-ying (Wang-yeh-fu)
NING-HSIA FU
Yen-ho-pu
Hung-ch'eng
Yeh-shih-pu
Plain
Ling Chou
(Ling-wu Hsien)
Ta-pa
Chin-chi Hsien
(Ning-ling)
Kuang-wu
Chu-k'ou
Plain
Tsou-yuan
Plain
Shih-kung
Ning-an-pu
Sha-p'o
Chung-wei Hsien
Hua-ma-ch'ih Hsien
Ting-pien Hsien
Suite Chou
Tai-yuan Fu
An-pien Hsien
Ping-yuan Hsien
Ta-lu-chi
Plain
Ching-yuan Hsien
Hai-ch'eng Hsien
HUANG HO
TSUI HO
CHOU FU
Hsu-yuan Chou
Huan Hsien
Huan Ho
Ho-shui Hsien
Ching-yang Fu
Chen-yuan Hsien
Hui-ning Hsien
An-ting Hsien
Ching-ning Chou
Liu-pan Shan 9000
Lung-te Hsien
Hua-p'ing Hsien
PING-LIANG FU
Ching Chou
(Ching-ch'uan)
Ning Chou
Ch'eng-ning Hsien
Ch'ang-wu Hsien
Ma-ying
8716
RUSSIAN EMPIRE
L. Baikal
MONGOLIA
MANCHURIA
KOREA
PEKING
Lop Nor
Kan-chou Fu
Lan-chou Fu
TIBET
LHASA
NEPAL
CHINA
INDIA
CALCUTTA
BURMA
BAY OF BENGAL
SIAM
CANTON
HONGKONG
CHINA SEA
Miles

CHINA

KAN-SU PROVINCE

Showing route traversed and mapped by

ERIC TEICHMAN, B.A.

Scale, 1/2,000,000 or 1 Inch = 31·56 Statute Miles.

10 0 10 20 30 40 50 100 Stat. Miles.

Reference.

Author's routes .....

Other routes .....

□ ...Walled city with magistrate

○ ...Small town, village, walled fort or monastery

Heights, in feet, are from Mr Clementi's barometer and boiling point observations; except those given in round numbers which are rough approximations only.

Published by the Royal

Note.

This map is from a recent prismatic compass traverse adjusted to positions determined astronomically by Mr. C. Clementi in 1907-8, given below, and to data obtained from Chinese and other maps. Owing to the lack of reliable data the relief can only be taken as approximately indicated. Further information on the construction is given in the note which accompanies the map in the "Geographical Journal" for December, 1916.

Positions determined by Mr. C. Clementi.

	Lat. N. ° ′ ″	Long. E. ° ′ ″
Kan-chou Fu	38 55 41	100 21 30
Tung-lo Hsien	38 49 18	100 48 15
Shui-chuan-tzu	38 22 53	101 40 8
Yung-ch'ang Hsien	38 15 20	101 56 2
Liang-chou Fu	37 55 35	102 33 44
Ching-pien-yi	37 40 51	102 45 9
Chen-chiang-yi	37 9 3	102 53 29
Wu sheng-yi	36 53 16	103 4 44
Nan-ta-tung	36 36 53	103 18 26
Lan-chou Fu	36 3 11	103 46 7
Kan-tsap-tien	35 48 41	104 16 54
Ma-ying	35 18 20	104 58 2
Ch'in Chou	34 35 35	105 33 46
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The double-page Plate between pages 344 and 345 of the present volume was wrongly folded in making up the number. In binding it should be reversed, so that the maps face one another with 1860 on the left and 1916 on the right.

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